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Availability and appropriateness of protective clothing in technical institutions in Central Kenya

Millicent Kimemia, Dinah Tumuti, Bosibori Oigo

Department of Fashion Design and Marketing, Kenyatta University, Nairobi, Kenya

Abstract
The aims 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. The study area was purposively selected as it had 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%) indicated 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. 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. Availability of signage indicating need for use of protective clothing was also identified as an important safety measure. The Pearson's correlation coefficient indicated 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. Moreover, 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.

Keywords: Availability, Appropriateness, Protective Clothing, Technical Institutions, Central Kenya

1. Introduction

Protective clothing material and design is supposed to protect against the specific hazards encountered in workplaces, cover and protect the areas of the body potentially exposed to the identified hazards and provide a comfortable and secure fit (Simiyu, 2002) [7]. 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) [14]. 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) [6]. 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) [10].

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) [4]. 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) [7].

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) [5] and (Trevor, 2008) [11] confirm 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 the hazard presents (Taylor, 2005) [5]. 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) [11]. Preformed or moulded 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) [4].

Burns, cuts, electrical shocks, 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) [11].

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) [5].

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 vapours (University of St. Andrews, 2008; University of Wollongong, 2009) [13, 15].

Problem Statement

The 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 many activities take place, most of which may require the use of protective clothing by students and staff. Most of the courses that are offered in the technical institutions involve practical lessons, which should be performed at the laboratory or workshops. Anyone involved in practical lessons is subsequently exposed to different hazards.

In Kenya, the need to use protective clothing has been stipulated in *The Occupational Safety and Health Act* of 2007. It is clearly stipulated in the Act that 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 to register safety consultants to assess the suitability and effectiveness of protective clothing and appliances (GoK, 2007a) [1]. The GoK (2007a) [1] further 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 was need for a study of 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. The study focused on selection, use and maintenance of protective clothing by students in Technical Institutions in central Kenya.

2. Materials and methods

The study area was conducted in Nyeri, Murang'a and Kirinyaga Counties in Central Kenya. The 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 because it was easily accessible to the researcher. Descriptive survey was used in the study. The 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.

The target population of the research comprised students of technical institutions in Murang'a, Nyeri and Kirinyaga Counties in Central Kenya, who belonged 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 nature of work in the mentioned departments also 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.

The sampling units for the study consisted of technical institutions in Nyeri, Murang'a and Kirinyaga Counties in Central Kenya. Purposive sampling method was used to identify 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 had been in the institutions for a considerable length of time and this meant they had 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 with three departments, the total number of respondents who participated in the study was 119.

The data collection tool used in the study was a questionnaire. The collected data was analysed using descriptive statistical method with the aid of 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.

3. Results and discussion

Availability and Appropriateness of Protective Clothing

The study sought 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 the Government of Kenya (GoK) (2008) [3] 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) [11]. 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 (Table 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.

Table 2: Checklist on Issues to be considered in the Selection of Protective Clothing

Type of protective clothing	Issues
Respirator	▪ Is the environment regularly monitored for hazardous substances? ▪ Are there other control measures in place to contain the hazard? ▪ Is respirator fit conducted? ▪ Respirator limitations considered ▪ Training in the use, storage and maintenance of the respirators
Eye protection	▪ Does it offer adequate protection against the hazard? ▪ Does it distort the vision of the user? ▪ Does it limit peripheral vision? ▪ Are there gaps between the side shields and face which might allow particles to enter?
Face protection	▪ Does it offer adequate protection against the hazard? ▪ Is eye protection also needed? ▪ Does it distort the vision of the user? ▪ Does it limit peripheral vision? ▪ Are there gaps between the side shields and face which might allow particles to enter?
Head protection	▪ Does it offer protection against the hazard? ▪ Are liners, chin straps and sweatbands used to keep it in place? ▪ Will it fit properly? ▪ Does it affect movement of the head? ▪ Will it be too bulky?
Hearing protection	▪ Does it offer adequate protection against noise? ▪ Are they comfortable to wear? ▪ Are they comfortable to wear? ▪ Are ear muffs adjustable? ▪ Any associated medical conditions with wearing ear protectors? ▪ Does it create pressure to the chin, head or behind the ears? ▪ Are there any other systems in place to alert wearer of any emergencies?
Hand protection	▪ Is it of adequate length to protect against the hazard? ▪ Is it to the correct size? ▪ Does if offer adequate protection or is it suitable to be used against the hazard? ▪ Will it restrict hand movement or interfere with the task? ▪ Is it too slippery or too bulky?
Leg and foot protection	▪ Does it offer adequate protection against the hazard? ▪ Is it too bulky? ▪ Is it comfortable to wear?
Body protection	▪ Is the clothing of the right size? ▪ Does it offer adequate protection against the hazard? ▪ Is it comfortable to wear?
Fall protection	▪ Is the harness suitable for the task at hand? ▪ Does it fit the user? ▪ Will it interfere with the task?

Source: University of St. Andrews (2008) [13]; University of Wollongong (2009) [15]

Protective Clothing and Task Performance

The respondents were asked to rate the effect of wearing protective clothing on the performance of their tasks. The results were as shown in Figure 1 below.

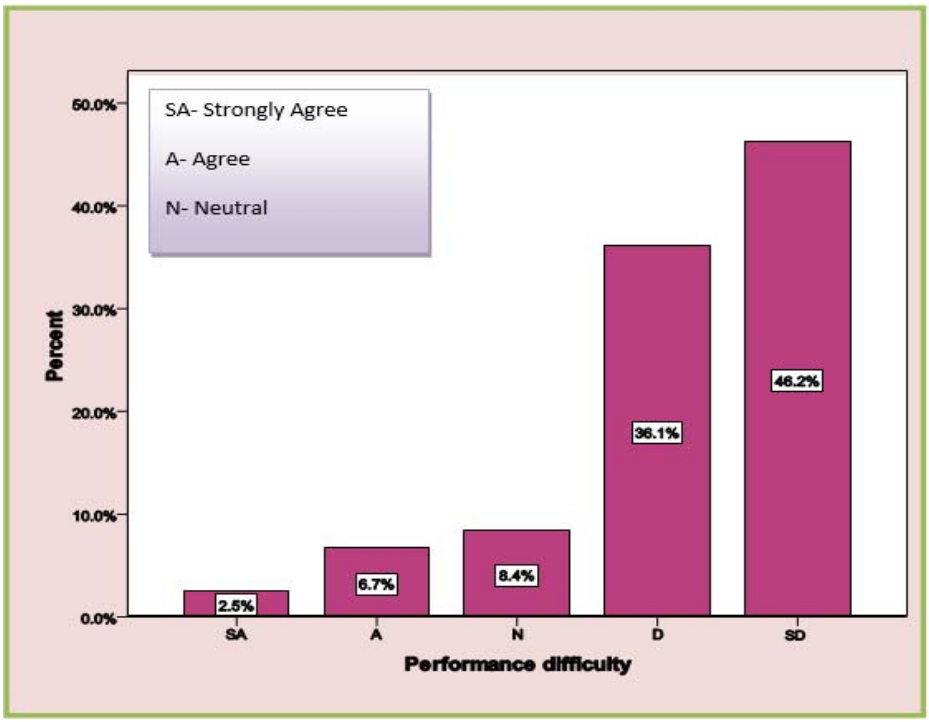

Fig 1: Protective clothing effect on task performance

As shown in Figure 1, 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). This would ease any problem associated with task performance.

From the study observations, it was noted that most of the lab coats that 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 the views of Torres (2007) [10] 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) [12]. The protective clothing that are not made of fabric should be well-fitting for the wearer and be suitable for the work environment (University of St. Andrews, 2008) [13].

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 shown in Figure 1.

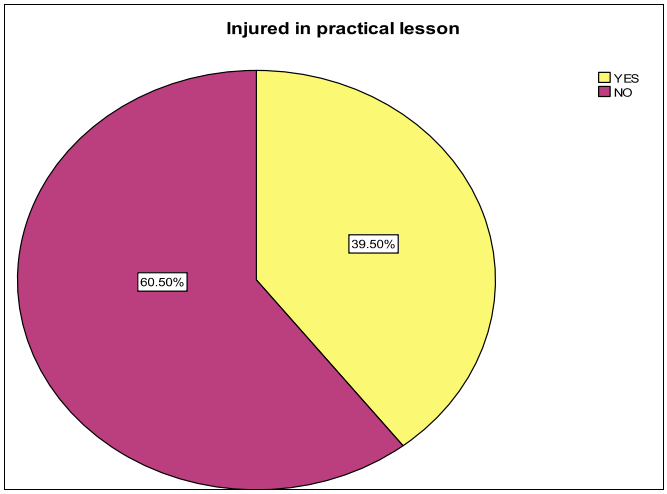

Fig 1: Injury in practical lesson

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) [11] notes that it is 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, it was concluded 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. Conclusion and recommendations

From the study findings discussed in this paper, 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. As such, 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. The students in technical institutions in Central Kenya should also be trained on the use of protective clothing by their course instructors/practical class lecturers on reporting to the institutions.

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