

IMPLEMENTATION OF INFORMATIVE MANNEQUIN TECHNOLOGY TO IMPROVE OCCUPATIONAL HEALTH AND SAFETY ASPECTS IN AUTOMOTIVE ENGINEERING WORKSHOP

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Abstract

The purpose of this study was to evaluate the use of Informative Mannequin technology that can speak to remind students about Standard Operating Procedures (SOP) when carrying out Practical Work in the automobile workshop area and its impact on improving Occupational Health and Safety (OHS) aspects. The method used in this study is a descriptive method with a sample of 60 students who are carrying out practical work in the Automotive Engineering Workshop of Universitas Pendidikan Indonesia. Data collection used an open questionnaire to measure the performance rating of OHS equipment when doing practical work. The result shows students' performance rating in using safety equipment during practical work after the use of Informative Mannequin technology is 78%. This is because mannequin technology as a learning medium makes it easier for students to understand the SOPs that apply when practical work in the workshop area. In addition, the mannequin technology used has audio media for delivering messages and awareness about the importance of OHS before starting practice so that it can remind students when there are SOPs that have not been implemented. The impact of using the mannequin technology is the improvement in the OHS aspects and student awareness regarding the SOPs when carrying out practical work in the Automotive Engineering Workshop area.

Keywords: Automotive engineering workshop, Informative mannequin technology, Occupational health and safety, Performance rating.

1. Introduction

Occupational Health and Safety (OHS) is a workplace condition that is healthy and safe for both the job and the company, as well as the community and the environment surrounding the factory or workplace. It is one method of protecting employees or workers from the dangers or threats of work accidents while at work, to create a safe work environment and assist with job achievement [1-3].

A mannequin is a body figure or statue that resembles a human in terms of body shape, legs, hands, head, and even face, which can resemble the original human face. Mannequins are also known as clothing statues because they can be dressed in human clothing. An informative mannequin is a type of mannequin with additional audio and visual features for information purposes. This type of mannequin is used not only for display but also as a medium for delivering specific information.

A workshop is a building that provides space and equipment to carry out construction or manufacture, and/or repair objects. Special treatment and design for this type of building are important. That is why many papers discussed special designs for buildings [4-10].

Automotive workshops have the meaning that the objects that are made or repaired are automotive products such as Cars and Motorcycles, and their components like Engines, Suspension, Wheel, Transmission, etc. Because the workshop is a work environment, it is required to follow and implement the rules or regulations regarding OHS to control all types of potential hazards that exist in the workplace environment.

Implementation of OHS is the responsibility of all parties. Educational institutions must also pay attention to aspects of OHS, which are not only the responsibility of students, but all elements of the campus need to support the creation of good occupational safety and health. According to Law No. 1 of 1970 which regulates occupational safety and health, it is explained that everyone who does work has the right to protection for his safety so OHS is important to be considered properly.

One of the areas that must implement OHS in the campus environment is the workshop area. A workshop is an area used by students for practical work. Practicum is very important, especially for students in Science and Engineering field [11-23]. The Automotive Engineering Workshop is one of the workshops at Universitas Pendidikan Indonesia that is used by students from the Automotive Engineering Education study program. This workshop is used by students for all types of practical work related to repair work from motorcycles, and cars, to other automotive components. In practical work, several aspects must be considered, one of which is the OHS aspects [24]. This has an impact on personal, safety, and the possibility of accidents will occur or can cause damage to occupational health that can have a direct impact on many parties [25].

In its implementation, practical activities carried out in Automotive Engineering Workshops of Universitas Pendidikan Indonesia still do not pay attention to occupational safety and health aspects. Based on the initial observations that have been made, less than 30% of students always use occupational safety and health equipment when practice takes place. Some examples are that there are students who do not use welding goggles when doing welding, students who do not use work

shirts when practicing, and students who do not use gloves when cutting materials. In addition, there are still students who do not have an awareness of the importance of OHS and still do not understand the impact that will occur if they do not use Personal Protective Equipment (PPE). The phenomenon that occurs in the automotive workshop can be concluded that the application of OHS still needs to be optimized considering the importance of OHS for students to support practice in the Automotive Engineering Workshop.

In the world of education, innovation is a very important thing to do to attract the attention of students and generate encouragement to learn [26-30]. Currently, technology is a supporter of teaching sustainability and learning activities, one of which is the mannequin simulator media [30, 31]. The development of mannequin simulators is used for various types of education, namely for training, research, motivation, and commercial evolution [32]. Mannequins are informative and can make it easier for students to carry out learning activities. However, the current mannequin technology is only limited to displaying props, so the information conveyed to students is only visual information. Therefore, the development of informative mannequins that have Visual-Audio capabilities needs to be developed. Thus, the learning process will involve the senses of sight, hearing, feeling, smell, and touch. Because Visual-Audio media is more effective in transferring knowledge [33, 34]. Informative mannequins are expected to encourage students to always be aware and remember the obligations that must be carried out before practical activities take place, in this case, students are encouraged to always remember the use of PPE before practical work in the workshop.

The goal of this study is to assess the use of Informative Mannequin technology, which can speak to remind students about SOP when performing Practical Work in an automobile workshop, and its impact on improving OHS aspects. The research uses a descriptive method with a sample of 60 students performing practical work in the Automotive Engineering Workshop of Universitas Pendidikan Indonesia.

The novelties of this study are (1) the informative mannequins used are equipped with audio speakers that will provide direction to students to use PPE and provide an explanation of the importance of OHS, (2) the informative mannequins made are not only used as displays but are also used as reminders that will remind students regarding the SOP in the Automotive Engineering Workshop area.

2. Literature Review

2.1. Informative mannequin

A mannequin is a body figure or statue resembling a human, both in terms of body shape, legs, hands, head, and even his face can be similar to the original human face. Mannequins are known as statues to display clothing because they can be worn with human clothes. As a prop, a mannequin can help learners to better understand the concept. Props as demonstration kits characterize the concept of the learning material used to demonstrate the topic, hence, the topic can be easily understood by the students [34]. The development of mannequin simulators used for education, training, and research is reviewed, tracing the motivations, evolution to commercial availability, and efforts toward assessment of the efficacy of those for teaching cardiopulmonary resuscitation, cardiology skills, anesthesia clinical skills, and crisis [35]. The informative mannequins used have audio speakers that

will direct students to use Personal Protective Equipment (PPE) and explain the importance of OHS. The informative mannequins created are used not only as displays but also as reminders to students about the SOP. Making informative mannequins that have audio features requires supporting components including 1) Mannequin, 2) a Portable Speaker, 3) Audio Software, and 4) Personal Protective Equipment (PPE) as shown in Fig. 1.

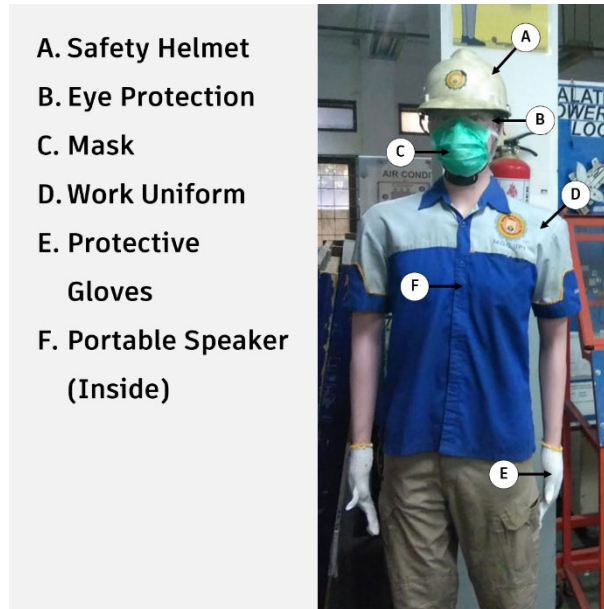


Fig. 1. Informative mannequin with basic Personal Protective Equipment (PPE).

The Informative Mannequin was prepared as a simulator of OHS props. This mannequin is equipped with a speaker that can emit sound media as a reminder or give instructions. A sound recording containing the use of Personal Protective Equipment (PPE) is inserted into the active speaker. The active speaker is placed inside the mannequin and turned on during the practical activity. The mannequins are placed near the entrance to the automotive workshop so that students can pay attention to the informative mannequin media before starting their practice.

2.2. Occupational health and safety (OHS)

OHS is a condition in work that is healthy and safe both for the job, and the company as well as for the community and the environment around the factory or workplace. OHS is an effort to improve the health of workers or employees in the community and company. Work safety is one way to protect employees or workers from the dangers or threats of work accidents during work which aims to create a safe work environment and support job achievement.

Based on the Decree of the Minister of Manpower No. 5 of 1996, every company that employs a workforce of one hundred or more that contains hazards posed by the characteristics of processes or materials that can result in work

accidents, must apply OHS. Almost all companies apply rules regarding OHS to improve company performance and employee work. According to the Decree of the Minister of Manpower of the Republic of Indonesia No. 463 of 1993, the purpose of occupational safety and health is to create a safe, healthy, and prosperous society and work environment. Based on the scope stipulated in Article 3 of Law no. 01 of 1970 concerning work safety, work safety requirements have been set for several aspects:

- (i) Prevent and reduce accidents.
- (ii) Prevent, reduce, and extinguish fires.
- (iii) Prevent and reduce blasting.
- (iv) Provide an opportunity or a way to save yourself in the event of a fire and other dangerous events.
- (v) Assist in accidents.
- (vi) Provide personal protective equipment. Prevent and control the emergence and spread of temperature, humidity, dust, dirt, smoke, wind, weather, light and radiation, sound, and vibration.
- (vii) Prevent and control the incidence of occupational diseases, both physical and psychological, poisoning, infection, and transmission.
- (viii) Obtain sufficient and appropriate application.
- (ix) Maintain good temperature and humidity.
- (x) Organize a good air refresher.
- (xi) Maintain health and order.

The basic philosophy of OHS is to protect workers' safety and health while performing their jobs by attempting to control all types of potential hazards that exist in the workplace environment. When all potential hazards have been eliminated and the safety standard limits have been met, it will contribute to the creation of a safe, healthy working environment and a smooth production process, which will reduce the risk of loss and have an impact on increasing productivity.

3. Method

The research method used in this research is a descriptive quantitative method, which is a research method aimed at describing existing phenomena [36, 37]. This research was conducted at the Automotive Engineering Workshop, Faculty of Technology and Vocational Education, Universitas Pendidikan Indonesia. The object of this research was the students of the Department of Mechanical Engineering Education, Automotive Engineering Concentration who are doing practical work with a total of 60 participants which has been taken by random sampling method from 130 students.

The instrument used to measure the student's Performance Rating of OHS aspect was by using a questionnaire. The questionnaire was in the form of questions and statements regarding several OHS rules followed by students during the practical work. The questionnaire aimed to determine the Performance Rating (%) of OHS as well as to measure student awareness when carrying out practical work in the Automotive Engineering Workshop area. The questionnaire contains questions and statements related to the implementation of OHS with several aspects, including 1) Physical, 2) Psychological, 3) Work Attitude, 4) Medical, 5) Workforce, and 6) Health Facility aspects.

The questionnaire was given twice, before implementing the Informative Mannequin (Pre-test) and after implementing the Informative Mannequin (Post-test) in the automotive workshop area as shown in Table 1. So there are two data of student's Performance Ratings (%) that can be compared to measure the effectiveness of Informative Mannequins use at the Automotive Engineering Workshop.

Table 1. Research process design.

| Pre-test | Treatment | Post-test |
|------------------------|-----------|------------------------|
| Performance Rating (%) | X | Performance Rating (%) |

4. Result and Discussion

The research data was taken from a questionnaire distributed to automotive students of Universitas Pendidikan Indonesia who carried out the practical work at the Automotive Engineering Workshop with a total of 60 participants. In this research data, there are 6 aspects evaluated, including Performance Rating (%) in all aspects of OHS from Physical (F), Psychological (P), Work Attitude (A), Medical (MD), Workforce (WF), to Health Facility (HF) aspects. The data obtained is in the form of a percentage score that shows the average Performance Rating (%) before and after using Informative Mannequins implementation in the workshop, as shown in Table 2.

Table 2. Students' performance rating (%) before and after the informative mannequin is installed in the workshop area.

| No. | Response | Aspects | | | | | | Total |
|-----|------------------------------------|---------|-----|-----|-----|-----|-----|------------|
| | | F | P | A | MD | WF | HF | |
| 1 | Before the mannequin was installed | 7% | 3% | 5% | 5% | 5% | 5% | 30% |
| 2 | After the mannequin is installed | 12% | 12% | 12% | 12% | 14% | 14% | 78% |

Based on the scores in Table 2, in general, there is an improvement in Performance Rating in all aspects of OHS. Before the Informative Mannequin was used, the average Performance Rating of students in applying OHS aspects in the practical work process was 30%. And after the Informative Mannequin was used, the average Performance Rating of students in implementing OHS aspects in the practical work process increased to 78%. The visualization of the Performance Rating improvement in all aspects of OHS can be seen in Fig. 2.

Figure 2 shows the improvement in student's Performance Rating in all aspects of OHS from Physical (F), Psychological (P), Work Attitude (A), Medical (MD), Workforce (WF), to Health Facility (HF) aspects. From Fig 2, it can be seen that the Physiological aspect experienced the lowest increase, only 5% on average. While the Psychology aspect increased very significantly from 3% to 12%. Work Attitude and Medical Device aspects have the same increase of 7%. For other aspects, both Workforce and Health Facilities increased significantly from 5% to 14%.

Based on the Performance Rating data in Fig. 2, the Physical aspect is the aspect that has the lowest improvement. This is because students have sufficient understanding and awareness of OHS aspects that affect the physical, such as the

use of Personal Protective Equipment (PPE) and understanding of Work Ergonomics. Students who carry out practical work previously already have an understanding of PPE and Work Ergonomics which are taught in separate courses, so the initial Performance Rating score for the Physical aspect is the highest score of all aspects with 7%.

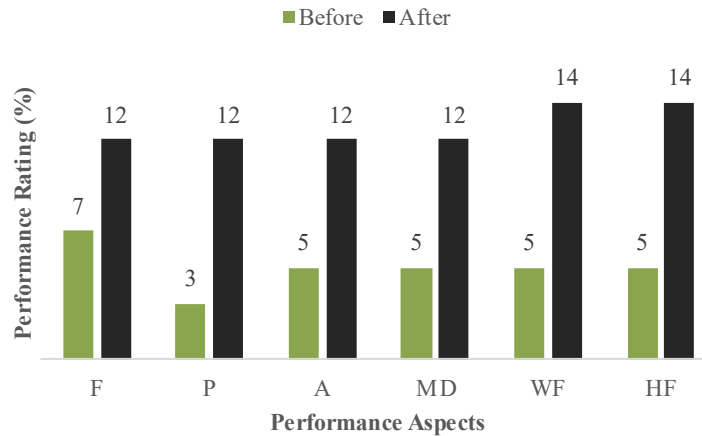


Fig. 2. Improvement in Performance Rating (%) in all aspects.

Different conditions occur in the aspect of Psychology performance. The Psychological aspects of students experienced a high increase. The initial condition before the Informative Mannequin was used showed that the Performance rating for the Psychological aspect was very low, only 3%. This is because when students do practical work in the workshop area, no one gives instructions regarding the steps for implementing OHS rules or reminds students when there are OHS rules that have not been followed. Meanwhile, after the informative mannequin is used in the workshop area, students have the Informative Mannequin media which functions as a giver of instructions and a reminder of the importance of implementing OHS in the work area, which affects the psychological aspects of students when doing practical work and increases a sense of security and comfort for students. This improves student learning when doing practical work [38]. Therefore, the increase in the Psychological aspect Performance Rating score is included in the highest category after the Informative Mannequin is used in the Automotive Workshop Area.

Aspects of Attitude and Workforce have the same initial Performance Rating score. The Informative Mannequin used in the workshop area has a voice feature that can provide direction and awareness to students before doing practical work so that when students start practical work, they are equipped with an understanding of the importance of applying OHS during practical work and have a positive attitude to practice [39]. In addition, giving direction and awareness to students before doing practical work affects student behavior when doing practical work [40] because there is communication and transfer of knowledge from Informative Mannequins to students. Students as a workforce who carry out practical work in the workshop area are more careful when doing practical work because they are aware of the risks of work accidents and the hazards that can occur in the work

area. This makes the Workforce aspect one of the most improved aspects of Performance Rating.

The Medical and Health Facilities Aspects have similarities with the Attitude and Workforce Aspects in terms of initial rating performance and improvement. This cannot be separated from the role of the Informative Mannequin who provides direction related to OHS, especially in terms of occupational health. When working in a workshop area that has a lot of equipment and work objects, many hazards can affect students' medical conditions. Informative mannequins act as reminders to students to better understand what hazards can occur in the work area. Thus, students know [41] and understand very well what dangers can occur and how to prevent them.

In general, using Informative Mannequin technology as a learning medium allows students to gain a better understanding of the SOPs that apply when performing practical work in the workshop area. Before beginning practice, the Informative Mannequin technology used has audio media for delivering messages and raising awareness about the importance of OHS so that it can remind students when SOPs are not followed.

5. Conclusion

The study aims to assess the use of Informative Mannequin technology, which can speak to remind students about SOP when performing Practical Work in an automobile workshop, and its impact on improving OHS aspects. The descriptive method was used in this study, with a sample of 60 students performing practical work in the Automotive Engineering Workshop at the Indonesia University of Education. An open questionnaire was used to collect data on the performance rating of OHS equipment when doing practical work. The outcome indicates that students' performance rating in using safety equipment during practical work after using mannequin technology is high. This is because using mannequin technology as a learning medium allows students to better understand the SOPs that apply when performing practical work in the workshop area. Furthermore, the mannequin technology used has audio media for delivering messages and raising awareness about the importance of OHS before beginning practice so that it can remind students when SOPs are not being followed. The impact of using mannequin technology is an improvement in OHS aspects as well as student awareness of SOP when performing practical work.

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