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The Impact of Educational Videos and Leaflets on the Use of PPE Among Welding Workshop Employees

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ABSTRACT

Work accidents among welders are often caused by the failure to use personal protective equipment (PPE). This quasi-experimental study, using a non-randomised pretest-posttest control group design, aimed to analyse the effectiveness of video versus leaflet-based counseling in improving knowledge, attitudes, and actions regarding PPE use. The study involved 36 welding workshop workers in Tanjung Gusta, Medan, divided into an intervention group (video; n=18) and a control group (leaflet; n=18). The results showed that both educational methods significantly improved workers' knowledge, attitude, and action scores ($p<0.05$). However, video counseling demonstrated superior effectiveness, evidenced by a significantly higher N-Gain value for knowledge (61.8 vs. 43.3) and a greater increase in mean scores for knowledge and attitude compared to the leaflet group ($p<0.05$). This study concludes that video education is more effective than leaflets for improving PPE-related knowledge and attitudes among welders. Therefore, integrating video-based education into occupational health programs is recommended to enhance worker safety behavior.

Keywords: welders, personal protective equipment, counseling

INTRODUCTION

Welding, a foundational process across numerous industries, presents substantial risks and hazards to its practitioners. While indispensable for construction, manufacturing, and repair work, the welding environment poses significant safety concerns that demand particular attention (Rikhotso et al., 2022; Wanjari & Wankhede, 2020). The health and safety of welders must be a paramount priority. Neglecting safety procedures can lead to severe injuries, long-term health issues, and considerable financial burdens for both workers and companies (Murugan & Sathiya, 2024). Personal Protective Equipment (PPE) is crucial for mitigating these hazards, creating a barrier between welders and their occupational risks. Commonly used PPE in welding workshops includes specialised eye protection, robust gloves, effective respirators, and protective clothing, all designed to minimise exposure to welding hazards (Brisbine et al., 2022; Wardhani & Sunarji, 2021).

Despite the recognised importance of PPE in welding workshops, significant issues persist regarding its low and inconsistent use among employees. Research indicates that although 83.6% of welders have access to PPE, only 14.4% report consistent use, with many opting for inadequate alternatives such as sunglasses instead of proper safety glasses (Esu & Ekanem, 2021). In a study conducted in Bayah, 57% of PPE usage was categorised as "good,"

yet 33% fell into the "poor" category, highlighting a concerning gap in compliance and understanding among workers (Suryana et al., 2024).

Several factors contribute to this underutilisation of PPE. A common reason is the discomfort associated with wearing protective gear, reported by approximately 41.4% of welders. Furthermore, inadequate training plays a significant role; only 7.7% of welders receive formal training on PPE use and safety practices, which correlates with lower adherence to safety protocols (Esu & Ekanem, 2021). Other factors include time constraints during the work process and negative attitudes towards wearing PPE, which can arise from a lack of awareness about the potential dangers associated with welding tasks (Maharja et al., 2022). The consequences of insufficient PPE use are severe and multifaceted. Welders face significant risks of occupational injuries and illnesses due to exposure to the physical and chemical hazards inherent in their work environment, including high temperatures, radiation, and toxic fumes (Budhathoki et al., 2014; Esu & Ekanem, 2021). Long-term health problems can arise from repeated exposure to these hazards, underscoring the urgent need for improved training and enforcement of PPE usage standards in welding workshops.

Education and training are vital for enhancing PPE utilisation and occupational safety behaviours, particularly in welding. Effective educational programmes can address barriers such as a lack of knowledge (Maharja et al., 2022; Nalugya et al., 2022). Various educational materials have proven effective in improving workers' understanding and adherence to safety. One study showed that healthcare workers who received structured training demonstrated better compliance with PPE protocols compared to those who did not receive such education (Shwe et al., 2021). Videos, especially animated ones, are particularly helpful in comprehending and implementing safety protocols (Laoh et al., 2023). Other research highlights the positive impact of educational videos on safe behaviours across diverse occupational settings, suggesting that visual learning aids can effectively modify safety practices (Dzaki et al., 2024). While leaflets and visual aids are useful, more interactive methods such as simulations and hands-on training yield superior results in enhancing knowledge and reducing accidents (Burke et al., 2006). The use of digital media for safety communication has shown promising results in construction environments, although barriers to implementation still exist (Edirisinghe & Lingard, 2016).

Based on initial observations and interviews with eight welders at Abadi Jaya Las and Banjarnahor Las workshops in Tanjung Gusta, Medan, it was found that the implementation of Occupational Safety and Health (OSH) is not yet optimal. This is evident from workers not using PPE for reasons such as laziness, discomfort, or forgetfulness. Additionally, some workers admitted to a limited understanding of the importance of PPE use, which inherently endangers their safety. Given these conditions and the documented potential of visual media in safety education, this study aims to compare the effectiveness of an educational intervention using videos versus leaflets to enhance workers' knowledge, attitudes, and practices regarding the importance of PPE use.

METHODS

This study employed a quasi-experimental design with a non-randomised pre-test-post-test control group. The research was conducted in Tanjung Gusta Sub-district, Medan City, North Sumatra, Indonesia, from 2nd April to 10th April 2022. Ethical approval for the study was obtained from the Health Research Ethics Committee of Universitas Prima Indonesia (Number: 024/KEPK/UNPRI/XI/2021).

The study subjects comprised 36 welding workshop workers from five locations within Tanjung Gusta Sub-district in 2022, selected using a total sampling technique. Subjects were allocated into two groups: an intervention group (n=18), which received education via video, and a control group (n=18), which received education via leaflets. Inclusion criteria stipulated

welding workshop workers aged over 18 years who consented to participate in Personal Protective Equipment (PPE) education. Exclusion criteria included being under 18 years of age, inability to read, refusal to participate in the education, or health conditions precluding an interview.

The dependent variables in this study were the welding workshop workers' knowledge, attitudes, and practices concerning PPE, measured both before and after the intervention. The independent variable was the educational method (video or leaflet). The educational content for both the video and leaflet was identical, covering key topics such as: hazard identification in welding, types of mandatory PPE, proper procedures for wearing and maintaining PPE, and case studies of accidents resulting from PPE negligence. The video intervention consisted of a 7-minute animated presentation designed to be visually engaging, while the leaflet presented the same information using text and static images. Respondent characteristics measured included age, length of service, education level, duration of exposure, and marital status. Data collection was carried out through questionnaires administered directly to respondents. The knowledge questionnaire comprised nine questions (score 0-9), the attitude questionnaire consisted of 15 statements (1-5 Likert scale), and the PPE use practice observation sheet (score 0-1). All respondents provided informed consent prior to participation.

Data analysis was performed using the STATCAL application. This began with frequency distribution of demographic data and mean values of the dependent variables. The Shapiro-Wilk test indicated that the data were not normally distributed. Bivariate analysis utilised the Wilcoxon test for mean differences before and after the intervention, the Mann-Whitney test for inter-group differences, and the N-Gain test to assess intervention effectiveness. Data were presented using graphs, frequency distribution tables, and cross-tabulations.

RESULTS

The intervention and control groups exhibited a comparable age distribution, with the majority of respondents in both groups falling into the 20-35 years and >35 years categories, each accounting for 55.6%. Regarding length of service, the intervention group was predominantly composed of respondents with <5 years of service (66.7%), whereas the control group primarily consisted of individuals with >5 years of service (61.1%).

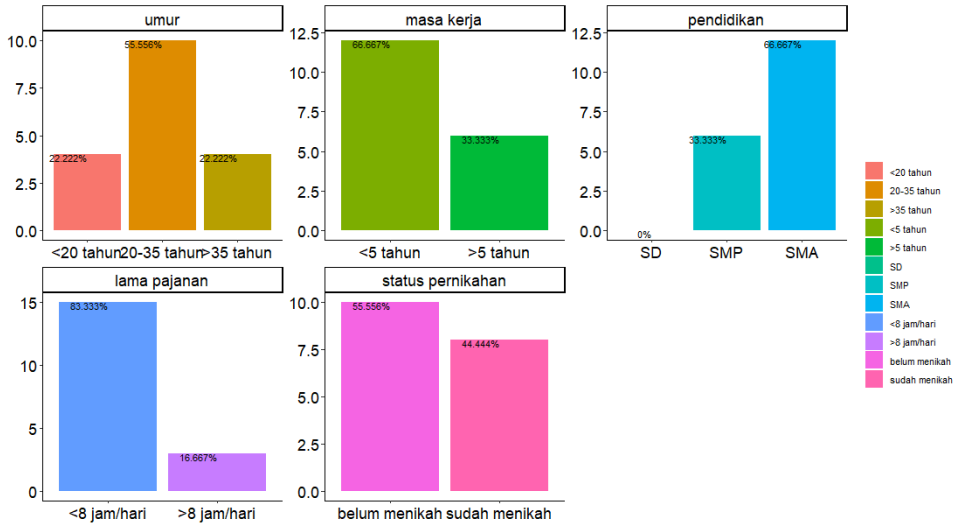

Figure 1. Respondent characteristics for the video intervention group

The highest educational attainment in both groups was senior high school, at 66.7%. A majority of respondents from both groups reported exposure durations of <8 hours/day, specifically 83.3% in the intervention group and 77.8% in the control group. Marital status presented a notable difference between the groups: the intervention group was largely comprised of single respondents (55.5%), while the control group was predominantly made up of married respondents (66.7%) (Figures 1 and 2).

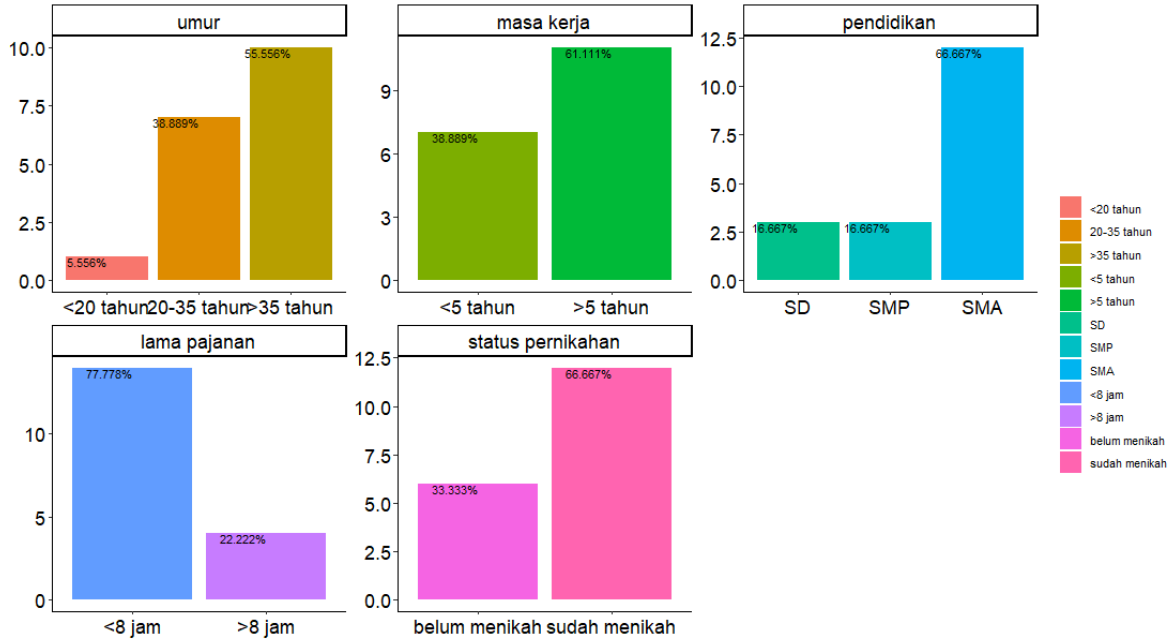

Figure 2. Respondent characteristics for the leaflet method group

Table 1 demonstrates that health education delivered via video and leaflet methods significantly improved the knowledge, attitudes, and practices (KAP) scores pertaining to personal protective equipment (PPE) among welding workshop employees. The intervention group exposed to video showed a greater increase in mean scores compared to the control group that received leaflets. Wilcoxon Signed-Rank Test analysis confirmed a significant difference ($p<0.05$) in employees' KAP scores before and after the intervention, for both video and leaflet modalities. Therefore, health education, particularly through video, is effective in enhancing the understanding and application of PPE use among welding workshop employees.

Table 1. Comparison of knowledge, attitude, and practice scores regarding personal protective equipment before and after video and leaflet interventions

Variable	Intervention Group (Video)				*p*	Control Group (Leaflet)				*p*
	Mean	SD	Min	Max		Mean	SD	Min	Max	
Knowledge										
Pretest	5,17	1,04	4	7	< 0,001	5,22	1,30	2	7	< 0,001
Postest	8,17	0,78	6	9		7,56	0,85	6	9	
Attitude										
Pretest	35,50	11,36	27	60	< 0,001	36,22	11,41	24	60	0,001
Postest	58,50	6,30	47	71		54,44	4,34	44	60	
Practice										
Pretest	2,44	1,09	1	5	0,001	2,28	1,17	1	4	0,003
Postest	4,72	1,90	2	7		4,56	1,97	2	7	

The results of the Mann-Whitney U test are presented in Table 2. These findings indicate that the intervention group, which received video-based education, showed a significantly greater increase in mean knowledge (p=0.023) and attitude (p=0.019) scores compared to the control group. However, the difference in the improvement of practice scores between the two groups was not statistically significant (p=0.775). The N-Gain test results for knowledge revealed a higher mean score for the intervention group (61.8) compared to the control group (43.3).

Table 2. Mann-Whitney U Test and N-Gain Scores

Variable	Mann-Whitney			N-Gain	
	Group	Mean	p value	Intervention Group	Control Group
Knowledge	Intervention	22.28	0,023		
	Control	14.72			
Attitude	Intervention	22.58	0,019	61,8	43,3
	Control	14.42			
Practice	Intervention	19.03	0,775		
	Control	17.97			

DISCUSSION

The findings of this study demonstrate that health education is a potent tool for improving knowledge, attitudes, and practices (KAP) related to Personal Protective Equipment (PPE) use among welding workshop employees. The significant increase in KAP scores in both the video and leaflet groups following the intervention underscores the value of structured educational initiatives in occupational health settings. This general finding is consistent with a large body of research that confirms the positive impact of educational programs on safety behaviors among industrial workers (Hatami & Kakavand, 2022; Zeidi et al., 2013).

A key finding of this study is the superior efficacy of video-based education over traditional leaflets in enhancing knowledge and attitudes. The intervention group, which was exposed to the video, showed a significantly greater increase in mean scores for knowledge and attitude compared to the control group. This is further substantiated by the higher N-Gain score for knowledge (61.8 vs. 43.3), indicating a more effective transfer of information. This result aligns with previous research highlighting the advantages of dynamic and multimedia-based learning. For instance, Lusk et al. (2003) found that a multimedia educational program significantly improved knowledge, attitude, and behavior regarding hearing protection among industrial workers. Videos can convey complex procedures and risks more engagingly through both visual and auditory channels, which can enhance comprehension, retention, and the development of a positive attitude toward safety protocols compared to static, text-based media (Burke et al., 2006).

Interestingly, while both video and leaflet interventions significantly improved practice scores from pre-test to post-test, the Mann-Whitney U test revealed no significant difference in the degree of improvement *between* the two groups. This suggests that while a more engaging medium like video is better for building a strong foundation of knowledge and a positive attitude, the ultimate translation to practice may be influenced by other factors. Once an employee is motivated to change, the specific medium that prompted the change may become less relevant. This phenomenon could be explained by research that points to organizational and environmental factors (such as the comfort of PPE, management commitment, and peer influence) as critical determinants of sustained PPE use (James et al.,

2023). Therefore, while education is a crucial first step, it is most effective when part of a comprehensive safety program that also addresses these practical barriers.

This study should be considered in light of its limitations. The assessment of practice was based on self-reported data, which may be subject to social desirability bias, leading participants to overstate their compliance. Future research could benefit from direct, objective observation of PPE use to validate these findings. Additionally, the study's follow-up was conducted immediately after the intervention, and thus does not provide insight into the long-term retention of knowledge or the sustainability of behavioral changes.

CONCLUSION

In conclusion, this study provides strong evidence that video-based health education is a more effective method than leaflets for improving knowledge and attitudes regarding PPE use among welders. While both interventions successfully improved practices in the short term, organizations should prioritize dynamic educational tools like videos to build a robust understanding and positive safety culture. To ensure that improved knowledge and attitudes translate into consistent, long-term safe practices, these educational efforts should be integrated within a broader safety framework that includes supervisory support and addresses practical barriers to PPE use.

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