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ORIGINAL ARTICLE

Enhancing PPE Awareness through SAFE Education among Manufacturing Workers in Sleman, Indonesia

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ABSTRACT

Introduction: Indonesia's growing infrastructure development increases the demand for precast concrete, which also increases workplace accidents due to the low safety awareness in PPE use. Audio media for safety education is considered an effective method to increase safety awareness on-site. This research aimed to examine the effects of SAFE education on enhancing safety awareness regarding the use of PPE. **Methods:** A quasi-experimental study was conducted with a total sample of 70 workers, divided into an Intervention Group (n=35) who received the SAFE (Sounding Awareness For Everyone) program and a Control Group (n=35) who received no intervention. The subjects received a 5-minute audio message on safety and PPE use, delivered over 14 consecutive days. The data on knowledge, attitude, and action were collected using a validated 45-item questionnaire and analyzed with the Wilcoxon and Mann-Whitney tests in SPSS 25. **Results:** Significant improvements were evident in knowledge, attitude, and action regarding the use of PPE among subjects in the intervention group. The mean knowledge score increased from 32.89 to 50.91, the attitude score increased from 31.20 to 49.17, and the action score increased from 30.34 to 48.71; all showed $p < 0.001$. Meanwhile, the control group showed no significant differences in mean scores before and after the intervention ($p > 0.05$). The Mann-Whitney test also showed significant differences between the intervention and control groups in post-test results ($p < 0.001$). **Conclusion:** Sounding Awareness For Everyone (SAFE) education was effective in improving safety awareness regarding PPE use among production workers at PT X.

Keywords: PPE, SAFE Education, Safety Awareness

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INTRODUCTION

Occupational accidents are a major public health concern worldwide, especially in low- and middle-income countries with poor safety enforcement (Shabani *et al*., 2024). Therefore, the International Labor Organization (ILO) reported that annually, nearly 3 million workers die from work-related accidents and diseases, approximately 2.6 million due to occupational diseases and 330,000 due to workplace accidents. The manufacturing sector is consistently reported as among the most hazardous industries and accounts for a significant share of these fatalities (International Labor Organization, 2023).

Indonesia's infrastructure development, which is increasingly widespread, such as toll roads and bridges, has become one of the strategic programs for encouraging employment, productivity, and increasing public welfare, which in turn encourages the need for precast concrete companies as one of the leading material suppliers in these constructions (Faidzin, 2021). Increased infrastructure projects, on the other hand, increase workplace accidents. In 2024, there were as many as 462,241 cases, 26% of which occurred in the manufacturing sector (Satu Data Ketenagakerjaan, 2025). According to BPJS Ketenagakerjaan, unsafe actions (34.43%), negligence in the use of PPE (32.12%), and unsafe conditions (32.25%) are the main causes (Verliza *et al*., 2024). Occupationally, accidents in Indonesia remain high because workers have low safety

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awareness, particularly regarding the use of PPE (Suryan *et al*., 2020).

Workplace accidents occurred more frequently, and ensuring workers' safety remains a primary issue in the manufacturing industry (Memon *et al*., 2021). Accident reports often indicate either a lack of safety awareness or a minimal level of it (Mohammadfam *et al*., 2021). Safety awareness always needs to be further developed, as most injuries are related to a lack of proper attention to safety practices (Saleem and Malik, 2022).

The level of understanding and awareness of workers regarding occupational safety would be improved as a strategic step with safety education within workplaces. Hence, it should be implemented in companies to reduce the risk of workplace accidents (Suhartoyo *et al*., 2022). To prevent accidents and work-related diseases that can further reduce productivity and lower service quality for consumers, a safe and healthy work environment is essential (Meutia, 2021).

While prior research used visual and audiovisual media for safety education, such methods require high concentration and active participation of workers (Wibawa *et al*., 2024; Ambarsari, 2024). Well-designed audio education can effectively support knowledge acquisition through improving attention, retention, and workers' acceptance (Wolpaw *et al*., 2022). The suitability of audio-based education to workplaces is high where multitasking is commonly done. Audio-based education is advantageous as it promotes engagement, improves information processing and memory, and offers flexibility to allow workers to access learning materials at any place and time, even during routine tasks (Zou *et al*., 2025).

Audio-based safety education was chosen as a more adaptable and practical alternative, considering the working conditions within the company, because it is flexible and accessible during working activities. Moreover, previous research has only considered the knowledge and attitude associated with PPE use (Rahma, 2024). This study will consider three aspects: knowledge, attitude, and action regarding PPE use. Considering the potential for audio-based approaches in occupational safety education, this is still not well explored in the manufacturing sector. This research aimed to examine the effects of SAFE education on enhancing safety awareness regarding the use of personal protective equipment (PPE) among manufacturing workers at PT X.

METHODS

This study was conducted at PT X in Sleman, Indonesia, from February to July 2025. It used a quasi-experimental design with a non-equivalent control group approach and has been approved by the Health Research Ethics Committee with Protocol ID Number 1.061/V/HREC/2025. The participants in the research were production workers who met the inclusion criteria, including willingness to participate and commitment to complete the study, as evidenced by signing an informed consent form. The exclusion criteria included night-shift workers and those who had participated in the initial survey.

The total production workers in this study was 70, equally divided into two groups: the intervention group (IG), which received the SAFE education intervention, and the control group, which did not. The intervention group consisted of workers from shelter 1 and 2, while the control group consisted of those from line 4 and the stockyard area. Due to operational constraints, night-shift workers were excluded from the sample to maintain timing consistency in the audio delivery, administered daily at 10.00 a.m. during the morning shift. Group allocation was based on work units sharing the highest risk, notably lifting activities using a portal gantry, which may be struck by products or rubber cages, or inner moulding. The SAFE (Sounding Awareness For Everyone) education intervention consisted of audio-delivered content regarding occupational safety, potential workplace hazards, the importance of using PPE, and its regulations. The intervention was implemented for two weeks (14 consecutive working days). The 14-day intervention was chosen to provide continuous reinforcement in terms of safety information, as regular education strengthens awareness and sustains behavioral change. This approach aligns with them (Sartina and Purnamawati, 2024), who found that ongoing education about PPE effectively enhances workers' understanding and compliance concerning safety procedures. Each session lasted five minutes and was delivered through audio media, allowing all production workers could easily access and understand the material. The sessions were consistently administered every day at 10.00 am. The audio-based SAFE education method was chosen because it is practical and effective for multitasking work environments, allowing safety awareness to be continuously reinforced without disturbing the workers' activities.

Data for the variables knowledge, attitude, and action were collected using a 45-item questionnaire developed based on the Indonesian Minister of Manpower's Regulation No. 8 of 2010 concerning Personal Protective Equipment (PPE). The instrument was tested for validity among 30 participants from a similar manufacturing concrete plant, yielding significance values (Sig) < 0.05 and Pearson Correlation coefficients > 0.361, while reliability testing produced a Cronbach's alpha of 0.753 (> 0.70), indicating that the questionnaire was both valid and reliable.

All participants completed a pre-test one day before the intervention and a post-test five days after the intervention ended. To avoid bias, the Mann-Whitney test was used to compare post-test scores between the experimental and control groups. This approach minimized the risk of confounding factors affecting the outcome after the intervention. Since the data did not meet the assumption of normality, the Wilcoxon and Mann-Whitney tests in SPSS 25 were used to compare safety awareness scores between the intervention group (IG) and the control group (CG) (Kishore and Jaswal, 2022).

RESULT

This study was conducted in PT X Sleman, specifically in the production area, over 14 days of measurement on the morning shift. Table 1 shows participants' ages, highest levels of education, and work experience. Out of 97 production workers, this research excluded 27 who worked night shifts or had participated in the initial survey. Thus, 70 participants were eligible, divided into two groups: the intervention group (IG) and the control group, each with 35 participants.

Table 1 showed that most participants were over 30 years old. Most had a Senior High School education (50%), followed by Junior High School (31.43%), and Elementary School (18.57%). In terms of work experience, most workers had 2 years of experience (31.43%).

According to the three figures, there were significant improvements in the intervention group's knowledge, attitudes, and actions regarding PPE use after receiving SAFE education. Figures 1, 2, and 3 depict comparisons of pre-test, post-test, and difference scores for the intervention group's knowledge, attitude, and action regarding PPE use. In all three bar charts, the post-test scores (red bars) are consistently higher than the pre-test scores (blue bars) across all participants, while the green bars represent the difference between pre- and post-test results, reflecting overall improvement after the 14-day SAFE education intervention.

Figure 1 shows a rise in knowledge scores (P1–P15), indicating improved understanding and awareness of PPE use. Figure 2 also shows that the attitude scores (P16–P30) are significantly higher, indicating that continuous audio-based education effectively fostered better safety attitudes. In the same way, Figure 3 illustrates that the action scores (P31–P45) are greatly improved, showing that the SAFE education successfully supported consistent safe practices and greater compliance with PPE use at work. Overall, the findings support that workers' knowledge, attitude, and action regarding the use of PPE were effectively improved by the audio-based SAFE program.

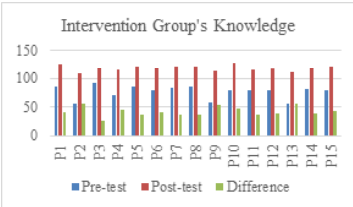

Figure 1. Recapitulation of Knowledge Scores on PPE Usage in the Intervention Group

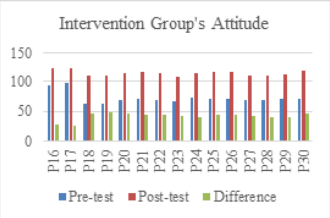

Figure 2. Recapitulation of Attitude Scores on PPE Usage in the Intervention Group

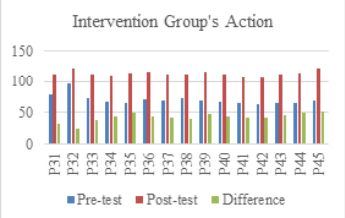

Figure 3. Recapitulation of Action Scores on PPE Usage in the Intervention Group

Results indicated improvement in knowledge and attitude regarding PPE use in workers after intervention as measured in the post survey. They showed that in the intervention group, there was an increase in knowledge scores as measured in pre and post evaluation. Data showed that the mean pre knowledge score was 32.89 which translated to mean post knowledge score of 50.91 indicating improvement of 18.02. Information closer to the mean attitude score also showed an increase from 31.20 to 49.17, equating to a mean score change of 17.97. Action collating showed a range from 30.34 to 48.71, with a mean post-value increase of 18.37, also indicating increased understanding of the necessity of PPE. All enhancements are improvements in PPE knowledge, attitude, and action post-SAFE intervention training.

The statistical test indicated significant improvement in knowledge for the intervention group. For the control group, there were no significant changes. The Mann-Whitney TEST also showed statistical significance, as demonstrated in other tables for the scoring difference. This reflects the enhancement of PPE training through SAFE integration regarding production workers' knowledge of PPE use.

The intervention group (IG) showed statistically significantly greater positive attitude changes ($p < 0.001$) than the Control Group (CG), which showed a statistically negligible change ($p = 0.396$). Based on the Mann-Whitney test comparison, there was a statistically significant positive influence that the SAFE intervention provided improvement of the attitude of PPE adoption to the production workers ($p = <0.001$). The investigation found that SAFE had positively influenced workers' attitudes towards the increased use of PPE. (Table 3).

Statistical examination showed that the Intervention Group (IG) demonstrated improved levels of action post-participation in the SAFE education ($p < 0.001$), whereas the control group (CG) showed no pertinent changes ($p = 0.336$). The difference in post-test scores between the two groups was also found to be significant ($p < 0.001$) using the Mann-Whitney test. This therefore indicates that SAFE has a positive influence on PPE-related safety actions among production workers (Table 4).

Table 1. Participants' Characteristics

Participants' characteristics	Category	n	Percentage (%)
Age	≤ 30 years	31	44.29
	> 30 years	39	55.71
Highest level of education	Elementary School	13	18.57
	Junior High School	22	31.43
	Senior High School	35	50
Work experience	1 year	13	18.57
	2 years	22	31.43
	3 years	20	28.57
	4 years	15	21.43

DISCUSSION

An individual's safety awareness means being aware of the potential hazards and taking responsibility for hazard prevention at work (Uzuntarla *et al*., 2020). According to Barling *et al*., safety awareness is split into two perspectives, cognitive and behavioral. The cognitive perspective involves understanding and mental awareness of workplace safety, along with behaviors that reinforcing operational safety. From the behavioral side, safety awareness incites actions to actively support operational safety (Saleem and Malik, 2022). Safety awareness involves the cognitive capacity to recognize safety concerns and potential workplace hazards; hence, it manifests an individual's knowledge and understanding of safety

Table 2. Wilcoxon and Mann-Whitney Test Results of Participants' Knowledge

Knowledge	Mean	p-value*	Conclusion
Intervention Group			
Pre-test	32.89		
Post-test	50.91		
Pre vs post – Wilcoxon		< 0.001	significant
Control Group			
Pre-test	31.31		
Post-test	31.29		
Pre vs post (control) – Wilcoxon		0.655	not significant
Intervention vs Control Group			
Post-test – Mann-Whitney		< 0.001	significant

* Significant if p-value < 0.05

procedures and practices in different contexts. Safety awareness is crucial in preserving individual safety and preventing accidents in different environments (Prasetiawan *et al*., 2024).

Safety awareness aims to help individuals to comprehend safety to be able to act safely and responsibly towards themselves and others regarding safety and the environment (Rijal, 2024). This awareness manifests in safety behaviors triggered by specific hazards. Lack of safety awareness, which includes the ability to recognize hazards and efficiently remove or mitigate them, may result in unsafe behaviors or create unsafe environments (Ruwanto *et al*., 2023).

Safety awareness indicates the extent to which workers are concerned about safety through their actions (Lee *et al*., 2015). In manufacturing companies, high safety awareness levels tend to have a positive influence on safety behaviors such as consistent use of PPE. Companies have to establish continuous safety education to develop safety awareness, since awareness cannot be formed immediately; it needs to be cultivated daily. Continuous education is effective in shaping changes in the behavior of workers, thereby helping in reducing workplace accident rates. In contrast, education that is conducted once or with excessively long intervals tends to be less effective since workers run the risk of forgetting the material delivered or reverting to old behavior (Ramadhani and Hasibuan, 2024).

Effective safety education enhances workers' understanding of the importance of using PPE to protect themselves from injuries and work-related illnesses (Tanzil *et al*., 2020). One of the main contributors to disaster avoidance is worker compliance and commitment to safety, and workers' behavior can be shaped by how information is delivered to them. An organization that consistently emphasizes the importance of sharing safety-related information can effectively reduce workplace accidents (Nordin *et al*., 2021).

PPE is equipment worn by workers to protect parts of their bodies or the whole body from potential hazards or workplace accidents. It is used as a control measure and is the final one used when the previous four control stages cannot be applied or have been implemented, and yet there are still hazards that may affect workers' health. Workers should consistently identify workplace hazards to ensure that PPE is appropriately used and functions as intended (Pratiwi *et al*., 2024). In addition, most workers still consider PPE unnecessary because they are more comfortable working without it out of habit (Bara and Susilawati, 2024). Reluctance to use PPE, low awareness that has led to its avoidance, incorrect use, or complete non-use, has greatly increased the likelihood of workplace accidents (Sehsah *et al*., 2020). Workers who do not use PPE have a threefold

Table 3. Wilcoxon and Mann-Whitney Test Results of Participants' Attitude

Attitude	Mean	p-value*	Conclusion
Intervention Group			
Pre-test	31.2		
Post-test	49.17		
Pre vs post – Wilcoxon		< 0.001	significant
Control Group			
Pre-test	30.09		
Post-test	30		
Pre vs post – Wilcoxon		0.396	not significant
Intervention vs Control Group			
Post-test – Mann-Whitney		< 0.001	significant

* Significant if p-value < 0.05

Table 4. Wilcoxon and Mann-Whitney Test Results of Participants' Action

Action	Mean	p-value*	Conclusion
Intervention Group			
Pre-test	30.34		
Post-test	48.71		
Pre vs post – Wilcoxon		< 0.001	significant
Control Group			
Pre-test	29		
Post-test	28.86		
Pre vs post – Wilcoxon		0.336	not significant
Intervention vs Control Group			
Post-test – Mann-Whitney		< 0.001	significant

possibility of getting injured compared to those who do (Atasoy *et al*., 2024)

Accordingly, the HIRADC analysis identified that the highest risks in PT X's production process are being struck by concrete products, rubber cages, or inner moldings during lifting with portal gantries. Moderate risks include hand injuries from bar-cutting machines and falls from moldings. The lack of safety awareness has made many workers neglect the use of mandatory PPE, such as safety helmets, vests, shoes, and gloves. Although PT X has conducted various forms of safety education, including safety induction, safety morning talks, toolbox meetings, and safety signage, worker participation remains low. However, worker participation is an important aspect of safety programs to minimize work-related injuries (Tappura *et al*., 2022).

The significant increase in the mean safety awareness score in the intervention group (IG) indicates that improved understanding and awareness have emerged among workers, driven by the SAFE education delivered via audio media. For this process to begin, sound stimuli are received by the ear and processed in the temporal lobe for identification and comprehension. This information is then processed in the cortex and transmitted to the thalamus, where it is stored in the prefrontal cortex as long-term memory. To improve retention and reinforce this information in memory, there is a core function of repetition, for example, which is done daily (Sousa, 2022). A worker can understand this kind of information in shaping his attitudes toward responding properly to a safety stimulus. The attitude serves as the basis for processing information and preparing for action, ultimately resulting in conscious behavior, such as consistent PPE use. Behavior change is the process by which an individual modifies their actions, habits, or behavior patterns. It is described as a targeted, intentional change in behavioral tendencies to achieve a specific aim, enhance well-being, or better adapt to changed circumstances (Ariwati *et al*., 2024).

Knowledge is an outcome of a cognitive process that occurs once an individual has perceived a particular object. Knowledge becomes an essential factor that influences and determines human acts (Noviarmi and Prananya, 2023). Knowledge plays a major role in shaping a person's attitudes and actions, as evidenced by Salcha *et al*. (2022), who found that knowledge-based attitudes tend to be more positive than those formed without a knowledge base. Continuous education is required to enhance workers' awareness and understanding of occupational hazards and their prevention measures (Sartina and Purnamawati, 2024). Workers who have been informed of the function and benefits of PPE are likely to use it continuously and in compliance with established procedures. On the other hand, individuals with low levels of information use what they know and tend to fail in operating PPE during the performance of their activities (Nugroho *et al*., 2023).

Workers' safety knowledge encourages them to engage in good safety behavior. Active worker involvement in safety can systematically lower the probability of human errors by raising their awareness. Thus, greater worker involvement in safety initiatives might be positively related to improved safety performance, as reflected in standard safety indicators such as accident rates (Saleem and Malik, 2022; Bernal *et al*., 2024). Knowledge gives the opportunity for attitude expression and the encouragement to act (Fenelia and Herbawani, 2022).

Understanding PPE use is imperative for mitigating the risk of workplace accidents. The PPE usage compliance is expected among workers who are motivated to utilize their knowledge. Knowledgeable individuals will be more inclined to use PPE compared to those with minimal knowledge. Knowledge significantly influences an individual's behavior (Noviarmi and Prananya, 2023). The extent of knowledge is positively correlated with the exhibition of desirable behaviors. Sufficient knowledge among workers correlates with a higher level of awareness than among their less knowledgeable counterparts, and awareness is determined by knowledge. Workers with a substantial level of knowledge will be more likely to adopt behaviors and practices that promote compliance with PPE use (Yenni, 2020). Workers who are aware of the importance of PPE in their work are also aware of the hazards in their workplace and thus possess a high level of awareness, which explains their adherence to PPE use (Noviarmi and Prananya, 2023).

An employee with safety information from instruction can make appropriate risk-related decisions relatively quickly (Siebert *et al*., 2021). The higher the level of workers' knowledge, the lower the likelihood of workplace accidents occurring (Putra *et al*., 2022). Lower levels of knowledge are associated with increased risks of workplace accidents. Knowledge is a key factor in

motivating individuals to take action, since behavior is fundamentally based on what an individual knows (Pratiwi *et al*., 2024). Knowledge plays a vital role in influencing workers' safety behavior, such as wearing PPE. Workers tend to be more compliant with safety procedures and protocols when they have greater knowledge of them, thereby contributing to a safer working environment. Safety behaviors are among the most integral actions that prevent accidents (Marcia *et al*., 2024).

Attitude is an individual's inner response or reaction to a stimulus or object. It reflects a person's readiness to accept or reject something, or to interact with it (Pratiwi *et al*., 2024). Attitude is also an outlook or feeling predisposed to act in a particular manner when confronted with an object encountered in life (Ghaniyannisa *et al*., 2023). An attitude develops when a person is exposed to information repeatedly; exposure leads to understanding and ultimately the development of that attitude. Knowledge level also influences attitude value; proper knowledge encourages people to evoke attitudes consistent with what they know (Muyassaroh and Isharyanti, 2020). Workers' attitudes toward PPE use are closely linked to knowledge and awareness; the better the attitude and behavior, the greater their awareness of PPE when doing the work. A positive attitude toward the importance of PPE improves adherence to its use (Darwanto and Astuti, 2024).

Sustained knowledge and acquired skills are the very foundation for attitude change, further shaping preliminary thoughts. Subsequently, behavior is developed and maintained through continued stimulation and actions (Noviarmi and Prananya, 2023). Attitudes can influence an individual's use of PPE, as attitudes are a starting point for developing behavior. In this regard, workers with positive attitudes are more likely to adhere to guidelines for PPE use, whereas those with negative attitudes tend to disregard or refuse to wear PPE (Dewi *et al*., 2020).

Individuals with positive attitudes are likely to observe safety during work, a factor that prevents accidents. Such workers understand that safety procedures and regulations exist to protect them and facilitate productivity. However, other workers with negative attitudes do not care about their surroundings and workplace hazards because they believe that safety regulations benefit the firm and burden them with redundant tasks that interfere with performance. As a result, workers who have negative attitudes easily practice unsafe actions, leading to accidents in the workplace (Pratiwi *et al*., 2024). Workers' attitudes toward using PPE are a reflection of their level of awareness and knowledge; the more positive the attitudes, the more aware the workers are of why they need PPE protection (Fadhilah *et al*., 2024).

An individual will act consistently with his knowledge when he has adequate motivation to do so based on the knowledge he possesses (Amalia *et al*., 2021). Workers acting in compliance with safety rules and procedures by using PPE is a concrete form of preventive effort against potential workplace accidents (Tiawati and Faidal, 2024). Generally, attitude influences behavior since it is connected with perception, motivation, and personality (Wirama and Wibowo, 2022). Attitude refers to the reflection of an evaluation or some sort of favorable or unfavorable reaction that an individual experiences upon exposure to a stimulus, indicating a ready-to-respond propensity (Kurusi *et al*., 2020). Workers develop increased compliance with protocols, better hazard awareness, and more proactive behavior when safety actions are integrated into daily workflows (Alshehri *et al*., 2022).

Behavioral change is influenced by the interplay of knowledge, attitude, and action. When knowledge and attitudes improve, positive safety behaviors are more likely to occur (Hakim *et al*., 2022). Compliance refers to the behaviors that individuals adopt based on their knowledge and understanding, which reduce the risk of workplace accidents and promote a safety-oriented mindset (Zegeorgous *et al*., 2020). Repeated interventions in the intervention group (IG) reinforced long-term memory retention, which subsequently influenced improvements in safety attitude and behavior (Ramadhani and Hasibuan, 2024). Repetition is an activity used to make impressions clearer and more enduring; it takes information from short-term memory to long-term memory. The repetition of material helps retain information longer (Afifaturrohma and Purnasari, 2020; Badawi *et al*., 2022).

Workers who received safety education are more compliant with PPE use than those who did not (Zegeorgous *et al*., 2020). Education can influence behavior, and the educational process involves changing deeply ingrained ways of behaving. These automatic changes will affect behavior (Noviarmi and Prananya, 2023). Workplace accident cases can be reduced by enhancing awareness and discipline in

PPE use and fostering a safety culture (Sartina and Purnamawati, 2024).

Safety awareness did not improve significantly in the control group (CG) because SAFE education was not conducted. In this absence of intervention, the control group (CG) failed to gain knowledge about safety and therefore did not experience any variation in awareness. This result emphasizes the need to educate workers on safety. Effective teaching improves employees' knowledge and nurtures safe behavior in the long run. These behavioral changes are short- and long-term, which means that the influence of safety education has a long-term effect (Ramadhani and Hasibuan, 2024).

According to the literature, audio-based interventions are an affordable, entertaining, and effective medium of health education (Zou *et al*., 2025). A study by Diddi *et al* (2023), on an analysis of 20 sound-based health education interventions implemented in developing countries with a total of 32,431 participants, reported similar findings and small but statistically significant improvements in knowledge, attitudes, and behavior change, varied by whether the programs were programmed locally (both adaptation) and run repeatedly. Other studies with visually challenged girls in Rwanda showed a remarkable increase in knowledge and practice of menstrual hygiene, with the subjects' confidence also higher because of programs they could listen to via audio recordings. These results underscore the capacity of audio media to be utilised to incorporate health messages, improve knowledge, foster positive perceptions, and guide behaviours towards initiatives to promote health (Bagirisano *et al*., 2025).

Perception and response in safety issues also depend on that; so when worker awareness of safety issues is increased, improving their safety behavior would be more likely. In this context, workers who have a good level of safety awareness may help to support good safety practices (Uzuntarla *et al*., 2020). Greater safety consciousness leads to better compliance with supported shown that PPE application worked no means are not the operative (Bahsin and Tualeka, 2024).

The implications of the findings from this study are very grave for manufacturing occupational health and safety management. For businesses, audio SAFE training incorporated into an on-going safety program can be a cost-effective way of increasing PPE compliance. Daily reinforcement with short audio messages permits workers to absorb safe information without interrupting their production duties and is especially relevant in higher-risk, high-throughput facilities.

From a policy perspective, the results argue for inclusion of ongoing and multimodal safety training in occupational health and safety policies. Make industries try and do more than just train once, and explore something more continuous education-wise that refocuses and refreshes their knowledge of safety regularly. Optimizing audio-based interventions, therefore, might be a simple, low-cost way to ensure workers continue to use PPE without affecting efficiency. Additionally, to ensure sustainability, policymakers need to establish monitoring and evaluation systems that enable tracking implementation and changes in workers' knowledge, attitudes, and behaviours. Embedding systems of repeated and diverse educational strategies into the culture and practice of work through workplace policies/OHS laws provides a means for companies and policymakers to more effectively promote a safety culture, reduce injuries on the job, contribute to overall health/well-being, and improve employee productivity.

The limitations of this study are as follows. The results are first derived from a single manufacturing company; therefore, the generalization of findings to other sectors or workplace preferences in practice is limited. Secondly, the intervention period was only 14 days and may not have been long enough to capture the longer-term effects of SAFE training on workers' safety awareness. Third, using self-reports to measure knowledge, attitudes, and actions could lead to participant bias and social desirability bias. It is recommended in the future to include objective behavioral observations, extend the follow-up period, and test various industrial populations to further verify and generalize audio-based safety education.

CONCLUSION

SAFE education through audio is a valuable aid in improving workers' knowledge, especially in the correct use of PPE. More scores/participants on IG might indicate more effective knowledge, attitudes, and workplace safety actions, which can be further improved through repeated safety education. However, in the CG, without implementation of the intervention design, no difference was found between before and after in fear knowledge, indicating the importance of safety education. Higher safety

awareness leads to greater compliance with safe work practices, particularly in the use of PPE.

The practical implication for company managers is to include SAFE training as part of regular safety activities, such as morning toolbox talks. Short voice messages can serve as an inexpensive, convenient supplement to PPE without disrupting production If implemented to the company practice, these can result in a better safety culture, more PPE use compliance and fewer accidents at work without affecting productivity.

CONFLICT OF INTEREST

The authors reported no conflicts of interest regarding the publication of this article.

AUTHOR CONTRIBUTION

In the study design, the research questionnaire was created by AMH, and the data analysis was conducted. HS participated in writing the manuscript and revising its structure and formatting. HS and NSSN were involved in supervising and guiding the writing of the manuscript.

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