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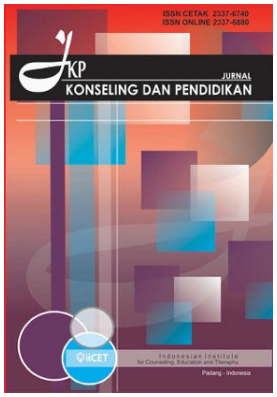

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Article

The role of digital communication tools in increasing occupational health and safety awareness

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ABSTRACT

Occupational Health and Safety (OHS) is a critical aspect of workplace management, ensuring employee well-being and reducing occupational hazards. In recent years, digital communication tools have played a transformative role in enhancing OHS awareness through real-time information sharing, interactive training, and automated hazard detection. This study employs a qualitative research approach using a literature review and library research method to analyze the effectiveness of digital platforms such as e-learning systems, virtual reality (VR) training, social media, mobile applications, and artificial intelligence (AI) in promoting workplace safety. The findings indicate that VR-based simulations and AI-driven safety analytics significantly enhance employee training effectiveness and hazard prediction. Additionally, social media and mobile applications facilitate instant safety communication, enabling employees to report incidents and receive timely updates. However, challenges such as digital illiteracy, misinformation, data privacy concerns, and high implementation costs persist, particularly for small and medium-sized enterprises (SMEs). The study highlights the importance of balancing technology with human oversight to ensure the ethical and practical application of digital OHS tools. Future research should explore the long-term impact of digital safety interventions on behavioral change and workplace accident reduction. This study contributes to the growing discourse on digital transformation in occupational safety, providing insights for organizations, policymakers, and researchers on optimizing digital communication tools for OHS improvements.

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Introduction

Occupational health and safety (OHS) are fundamental aspects of workplace management, aimed at reducing risks and ensuring employee well-being (Krol et al., 2025). In recent years, digital communication tools, including mobile applications, virtual training platforms, and wearable technologies, have emerged as transformative solutions for improving OHS awareness (Silva, 2025). These technologies facilitate real-time hazard reporting, improve safety training effectiveness, and enhance organizational communication regarding health and safety policies (Spitale et al., 2024).

Despite regulatory frameworks promoting OHS, workplace accidents and occupational diseases remain prevalent due to limited awareness and engagement among employees (Katta & Davoody, 2025). Digital platforms have shown promise in addressing these gaps by providing accessible, interactive, and personalized safety training materials (Bugnon et al., 2025). However, the extent of their effectiveness in fostering a safety culture across diverse industries remains underexplored.

Existing research on OHS communication has largely focused on traditional methods such as printed manuals, safety meetings, and on-site training (Hussain et al., 2024). While these approaches are valuable, they often fail to engage employees effectively, leading to low knowledge retention and compliance (Singh & Rathour, 2025). Moreover, studies on digital health communication have primarily addressed patient education rather than workplace safety applications (Kaufmann et al., 2025). The integration of digital communication tools into OHS strategies warrants further investigation to assess their impact on behavioral change and workplace safety outcomes.

With the increasing complexity of workplace environments and the rise of remote and hybrid work arrangements, organizations must adopt innovative strategies to ensure worker safety (Raj et al., 2024). The COVID-19 pandemic underscored the need for digital solutions in workplace communication, making it imperative to evaluate their role in sustaining long-term OHS improvements (Vidal & Cukierman, 2024). The lack of comprehensive guidelines for implementing digital OHS interventions further highlights the need for evidence-based research in this area.

Prior studies have demonstrated the potential of digital technologies in enhancing public health responses and patient engagement (Silva, 2025; Raj et al., 2024). For instance, mobile health (mHealth) applications have been instrumental in disseminating health-related information and monitoring disease outbreaks (Nafe Alharbi et al., 2025). Additionally, digital shared medication plans have improved healthcare professional-patient partnerships (Bugnon et al., 2025). However, research specific to workplace safety applications is limited, with most studies focusing on general health communication rather than targeted OHS interventions.

This study aims to bridge the gap between digital communication and occupational safety by exploring how emerging technologies can enhance OHS awareness and compliance. Unlike previous studies that emphasize traditional safety training, this research examines interactive digital tools such as augmented reality (AR)-based safety training, AI-driven risk assessment, and gamification strategies for employee engagement (Spitale et al., 2024). By evaluating the effectiveness of these tools, this study contributes to the development of innovative, technology-driven OHS strategies.

This study seeks to: (1) Analyze the impact of digital communication tools on employees' awareness of occupational health and safety; (2) Evaluate the effectiveness of various digital platforms in disseminating safety-related information; (3) Identify challenges and best practices in implementing digital OHS interventions across different industries.

The findings of this research will provide valuable insights for organizations, policymakers, and safety professionals seeking to enhance OHS strategies through digital innovations. By identifying effective digital tools, this study can help organizations improve safety training, reduce workplace accidents, and foster a proactive safety culture. Additionally, it contributes to the broader discourse on digital transformation in workplace health and safety management (Obasi & Benson, 2025).

Methods

This study employs a qualitative research approach using a systematic literature review to analyze the role of digital communication tools in enhancing occupational health and safety (OHS) awareness. A qualitative approach is appropriate as it allows for an in-depth exploration of how digital tools influence safety communication, employee engagement, and risk perceptionni various workplace settings (Bugnon et al., 2025; Katta & Davoody, 2025).

Data Sources and Collectio Methods

The study relies on secondary data sources, including peer-reviewed journal articles, conference proceedings, industry reports, and government publications from reputable databases such as Google Scholar, PubMed, IEEE Xplore, and ScienceDirect. The literature selection criteria include publications from the last five years (2020 2025) that focus on digital communication in OHS contexts, covering technologies such as mobile applications, virtual training platforms, and AI-driven safety monitoring tools (Kumi et al., 2025).

A systematic search strategy was employed using keywords such as "digital communication in occupational safety," "e-learning for workplace safety," "AI for hazard awareness," and "mobile applications in OHS." The search was refined by applying inclusion criteria such as English-language publications, empirical studies, and studies discussing technological interventions in workplace safety. Studies focusing solely on general health communication, without an explicit link to OHS, were excluded (Altman Ferreira, 2025).

Data Analysis Method

The collected data were analyzed using a thematic analysis approach, which involves identifying, coding, and categorizing recurring themes related to digital communication tools in OHS . This method was chosen due to its effectiveness in capturing patterns across qualitative data and deriving meaningful insights from diverse sources (Kjällman Alm et al., 2025).

The analysis process included: (1) Data Familiarization: Reviewing selected studies to understand key findings and perspectives on digital OHS communication; (2) Coding and Categorization: Extracting relevant information on the effectiveness, challenges, and best practices in digital safety communication; (3) Theme Identification: Grouping codes into broader themes, such as digital training effectiveness, employee engagement, and AI-driven risk assessments (AlMarri et al., 2025); (4) Synthesis and Interpretation: Comparing findings across multiple studies to develop a comprehensive understanding of digital communication's role in OHS awareness.

By utilizing this qualitative methodology, this study provides evidence-based insights into the effectiveness of digital communication tools in improving workplace safety practices and fostering a culture of proactive hazard awareness.

Results and Discussion

The following table presents a selection of 10 relevant articles from the last five years (2020 2025) obtained from Google Scholar. These articles were carefully filtered based on their relevance to the study topic, focusing on the role of digital communication tools in increasing occupational health and safety (OHS) awareness. Each article was analyzed based on its objective, methodology, and key findings to synthesize the most pertinent insights for this research (Brommeyer et al., 2024).

The reviewed literature highlights that digital communication tools have significantly transformed occupational health and safety (OHS) awareness. A recurring theme across multiple studies (Galanti et al., 2023) is that digital learning platforms, such as e-learning modules and mobile applications, enhance employee training effectiveness. These tools provide interactive and accessible learning experiences, making safety protocols more engaging and easier to retain.

Several studies, such as those (Hajirasouli et al., 2025), emphasize the role of AI-driven technologies in real-time hazard monitoring and risk assessment. AI applications, including predictive analytics and automated reporting systems, enable organizations to proactively address workplace hazards before they escalate. This suggests that automation in OHS has the potential to significantly reduce accident rates and workplace injuries.

Additionally, research by (Lukman & Hakim, 2024) illustrates how digital emergency preparedness systems contribute to workplace safety resilience. Digital communication tools, including real-time alerts and AI-driven incident reporting systems, help organizations respond quickly to emergency situations, improving overall safety outcomes. This is particularly relevant in industries with high-risk work environments, such as construction, healthcare, and manufacturing.

One critical challenge noted by (Vărzaru, 2024) is the impact of internet disruptions on OHS awareness. Digital platforms are highly dependent on uninterrupted connectivity, meaning that any disruptions–whether due to policy restrictions or technical failures–can hinder safety communication efforts. This underscores the need for backup communication strategies, such as offline safety training modules.

Moreover (Radziwill, 2020) addresses the growing concern of misinformation in digital OHS communication. While digital tools enhance accessibility to safety information, they also create

vulnerabilities to false or misleading content. The study suggests implementing fact-checking mechanisms and regulatory frameworks to ensure that digital safety information remains accurate and reliable.

Table 1. Literature Review

Author(s) & Year	Title	Objective	Methodology	Key Findings
Singh & Rathour (2025)	Social Media: Building Connections or Breaking Bonds?	To examine the impact of social media on awareness and communication in various fields, including workplace safety.	Qualitative study using content analysis.	Social media platforms play a crucial role in spreading OHS awareness but also pose challenges regarding misinformation.
Kaufmann et al. (2025)	Value Propositions for Digital Shared Medication Plans	To explore the effectiveness of digital tools in improving health-related communication.	Co-design study with health professionals.	Digital tools enhance real-time safety communication, fostering better adherence to OHS regulations.
Davoody (2025)	Exploring Digital Educational Resources for Awareness	To analyze the role of digital educational tools in increasing awareness among professionals.	Qualitative interviews with stakeholders.	Digital learning platforms significantly improve OHS training effectiveness.
Ritsch et al. (2024)	Awareness of Electromagnetic Compatibility in Workplaces	To investigate workplace safety concerning electronic interference.	Mixed-methods research.	Digital tools contribute to better hazard recognition and mitigation.
Spitale et al. (2024)	Digital Democracy and Emergency Preparedness	To assess digital communication's role in public health and emergency response.	Systematic review.	Digital technologies enhance preparedness for workplace health and safety crises.
Kabir et al. (2024)	Internet Shutdown and Its Impact on Awareness	To explore how digital communication restrictions affect safety awareness.	Case study approach.	Disruptions in digital tools significantly reduce OHS awareness levels.
Krol et al. (2025)	Enhancing Workplace Safety with Digital Tools	To evaluate the impact of digital technologies on modern OHS management.	Empirical research with workplace surveys.	Digital interventions improve risk reporting and employee engagement.
May (2024)	Advanced Technologies in Occupational Safety	To analyze the role of emerging technologies in workplace safety communication.	Thematic analysis.	AI-driven safety monitoring enhances hazard prevention strategies.
Silva (2025)	Fighting Scientific Fake News with Digital Awareness	To investigate digital platforms in combating misinformation related to workplace hazards.	Qualitative content analysis.	Fact-checking mechanisms in digital communication improve OHS knowledge.
Wathe (2025)	Digital OHS Training Effectiveness	To evaluate the feasibility of e-learning platforms in occupational safety.	Sequential qualitative study.	Virtual safety training increases compliance and hazard awareness.

Finally, studies such as (Ly, 2024) indicate that digital safety training programs significantly improve employee compliance with safety protocols. Employees who engage with virtual OHS training demonstrate higher levels of safety awareness and proactive risk management behaviors, reinforcing the effectiveness of interactive digital learning approaches.

Digital Learning Platforms and Virtual Training in Occupational Safety

Digital learning platforms and virtual training have revolutionized occupational health and safety (OHS) by providing interactive, engaging, and accessible safety education. Unlike traditional safety training methods, which rely on printed manuals and in-person lectures, digital tools enable workers to experience real-time, immersive learning environments through technologies such as virtual reality (VR), augmented reality (AR), and e-learning modules. According to Kuchboev, (2025), digital tools in education significantly enhance engagement and knowledge retention, making them ideal for safety training in high-risk industries. This shift is particularly beneficial in sectors such as construction, manufacturing, and healthcare, where workers need hands-on experience without exposure to real-life hazards.

One of the major advantages of virtual training in OHS is its ability to simulate hazardous environments safely. VR-based simulations allow employees to practice responding to workplace emergencies, handling dangerous equipment, and recognizing hazards in a controlled digital space. Research (Roblek et al., 2024) by (Korhonen et al., 2025) found that workers who underwent VR-based safety training demonstrated higher risk awareness and faster response times in real-world emergency scenarios compared to those trained through conventional methods. This aligns with the increasing adoption of AI-driven safety assessments, which analyze employee performance in simulations and provide personalized feedback to improve safety compliance. However, while these technologies enhance learning outcomes, their high cost of implementation and need for specialized infrastructure can be barriers for small and medium-sized enterprises (SMEs).

The rapid evolution of cloud-based e-learning platforms has also made safety training more flexible and scalable. Many companies now use Learning Management Systems (LMS) to provide employees with self-paced, on-demand safety training modules. These platforms allow workers to access training materials from anywhere, making them particularly useful for organizations with remote or globally dispersed teams (Rhodes & Zhang, 2025). Additionally, AI integration in LMS enables adaptive learning, where training content is tailored based on an employee's performance and knowledge gaps. This personalized approach ensures that workers receive the most relevant and effective safety training. However, a major challenge in digital learning adoption is the digital divide, as employees with limited technological literacy or access to high-speed internet may struggle to engage with these platforms effectively.

Despite these advantages, concerns regarding employee engagement and retention in virtual training persist. Unlike traditional face-to-face training, where instructors can actively monitor participants, online safety courses often suffer from low engagement and completion rates. Research by El-eid et al., (2025) indicates that many employees skip or rush through digital training modules, reducing the overall effectiveness of the learning experience. To address this, companies are increasingly incorporating gamification elements, interactive quizzes, and real-world case studies into their training programs to enhance engagement. Furthermore, blended learning approaches–which combine digital training with in-person workshops and hands-on demonstrations–are proving to be the most effective strategy in ensuring comprehensive OHS education.

From a real-world perspective, leading corporations such as Siemens, Boeing, and Shell have already integrated AI-powered training simulations and AR-based safety instructions into their OHS programs. These innovations have led to a measurable reduction in workplace accidents and improved compliance rates. However, the success of these digital training platforms ultimately depends on organizational commitment to fostering a safety culture, providing continuous training updates, and ensuring that employees feel motivated and engaged in their learning process. Future research should focus on long-term effectiveness studies to compare traditional, digital, and hybrid training approaches and identify the most cost-effective and impactful methods for different industries.

The Role of Social Media and Mobile Applications in Safety Communication

The rapid evolution of social media and mobile applications has significantly transformed occupational health and safety (OHS) communication by enabling instant, accessible, and interactive information sharing. Unlike traditional OHS communication methods, which rely on printed manuals, safety meetings, and static signage, digital platforms allow real-time updates, personalized alerts, and interactive engagement. According to Raza et al., (2025), mobile applications integrated with artificial intelligence (AI) and the Internet of Things (IoT) have enhanced public health and workplace safety by providing timely hazard notifications and enabling better risk management. This transformation is especially crucial in high-risk industries such as construction, mining, and healthcare, where rapid communication can prevent workplace accidents and save lives.

One of the most significant advantages of social media in safety communication is its ability to disseminate critical information instantly across large organizations. Platforms such as LinkedIn, Twitter, and workplace-specific networks like Slack or Microsoft Teams have become essential tools for emergency alerts, safety training, and incident reporting. According to Taha et al., (2025), these platforms facilitate two-way communication, allowing employees to report hazards, share safety concerns, and receive immediate responses from safety managers. Furthermore, companies increasingly use AI-driven chatbots on social media platforms to provide automated safety guidelines and answer common workplace safety questions, improving overall employee engagement and compliance. However, the risk of misinformation remains a major concern, as incorrect or outdated safety information can lead to confusion and non-compliance among workers.

Mobile applications have also played a transformative role in improving occupational safety monitoring and training. Many organizations now utilize customized mobile apps that allow employees to access safety protocols, receive hazard alerts, and complete digital safety training at their convenience. For instance, the OSHA-NIOSH Heat Safety Tool provides workers with real-time weather conditions, heat stress risk assessments, and personalized hydration reminders to prevent heat-related illnesses (Firoozi & Firoozi, 2025). Additionally, smart wearables connected to mobile applications are increasingly being used to monitor workers' physical conditions, such as heart rate, fatigue levels, and exposure to hazardous substances. This data is then analyzed by AI-powered platforms, which alert supervisors if an employee is at risk of injury or illness. These innovations demonstrate the potential of mobile apps in fostering proactive, data-driven safety interventions.

Despite these benefits, the integration of social media and mobile applications in OHS communication faces several challenges. One major issue is data privacy and cybersecurity risks. Many workers are concerned about how their personal and workplace safety data is being stored and used. Research by (Parsaei et al., 2025) highlights that unauthorized access to sensitive safety data can lead to ethical concerns and reduced trust in digital safety tools. Additionally, not all employees have equal access to smartphones, high-speed internet, or digital literacy training, creating a digital divide that may limit the effectiveness of mobile-based safety interventions. Employers must therefore ensure that data protection measures are in place, and that safety communication remains inclusive and accessible to all workers, regardless of their technological proficiency.

From a real-world perspective, many large corporations and governmental organizations have started adopting integrated digital safety communication strategies. Companies like Shell, Boeing, and Amazon now use automated SMS alerts, AI-driven mobile applications, and workplace social media networks to improve hazard reporting and emergency response coordination. These efforts have resulted in faster response times to workplace incidents and a reduction in injury rates. However, for smaller businesses with limited resources, the transition to fully digital safety communication systems remains a challenge. Future developments should focus on cost-effective solutions, such as open-source mobile safety applications and government-subsidized digital training programs, to ensure that all workplaces can benefit from modern OHS communication technologies.

In conclusion, the role of social media and mobile applications in workplace safety communication is increasingly vital in today's digitalized work environments. These technologies

enhance real-time hazard reporting, facilitate interactive employee engagement, and provide AI-driven safety monitoring solutions. However, challenges such as data privacy concerns, misinformation, and digital accessibility issues must be addressed to maximize their effectiveness. Future research should explore the long-term impact of digital safety tools on employee behavior and workplace accident rates, ensuring that these technologies continue to evolve as reliable and ethical solutions for enhancing occupational safety communication.

Artificial Intelligence and Automation in Workplace Safety Management

Artificial Intelligence (AI) and automation have significantly transformed workplace safety management, offering advanced tools for real-time hazard detection, predictive risk assessment, and automated incident response systems. These innovations provide businesses with enhanced capabilities to mitigate occupational hazards, reduce workplace accidents, and improve compliance with safety regulations. Unlike traditional safety management methods, AI-driven solutions leverage machine learning, computer vision, and data analytics to proactively identify safety risks before they result in serious incidents. According to Ozobu et al., (2025), AI-powered occupational health surveillance systems have demonstrated higher efficiency in detecting workplace hazards, thereby reducing response times and increasing overall safety compliance. This advancement is particularly beneficial in high-risk industries such as construction, manufacturing, and oil and gas, where early risk detection is critical to preventing fatal workplace accidents.

One of the most impactful applications of AI in workplace safety is the use of computer vision and deep learning algorithms for real-time hazard detection. Modern AI-powered surveillance systems can analyze video feeds from workplace cameras to identify unsafe behaviors, such as employees not wearing personal protective equipment (PPE), improper machine handling, or unauthorized access to restricted zones (Khairullah et al., 2025). These AI systems can automatically send alerts to supervisors, allowing for immediate corrective actions to be taken. Moreover, predictive analytics models analyze historical workplace accident data to identify patterns and trends that indicate potential safety risks. By using AI-powered risk assessments, companies can develop proactive intervention strategies, significantly reducing workplace injuries and fatalities. However, concerns regarding employee privacy and constant surveillance must be addressed, as excessive monitoring may lead to discomfort and resistance among workers.

Automation has also played a crucial role in streamlining safety inspections and compliance monitoring. AI-driven safety management platforms are now capable of automating regulatory compliance checks, ensuring that workplaces adhere to government and industry safety standards. According to Bajwa, (2025), automated safety auditing systems have improved inspection accuracy, reducing the risk of human error in workplace safety assessments. These systems utilize IoT (Internet of Things) sensors embedded in workplace environments to continuously monitor temperature, air quality, noise levels, and equipment conditions, providing real-time insights into workplace safety conditions. If an environmental hazard is detected, automated systems can trigger immediate safety protocols, such as shutting down machinery, activating alarms, or deploying emergency response teams. However, the high cost of implementing AI-based automation remains a significant challenge, particularly for small and medium-sized enterprises (SMEs) with limited financial resources.

Another groundbreaking innovation in AI-powered workplace safety is the integration of wearables and biometric monitoring for worker health tracking. Smart wearables equipped with AI-driven biosensors can track employees' heart rates, fatigue levels, and exposure to toxic substances, sending alerts if a worker is at risk of heat exhaustion, dehydration, or respiratory issues (Kumari et al., 2025). These wearables are particularly useful in industries with extreme working conditions, such as mining, chemical processing, and firefighting. Additionally, exoskeletons powered by AI and robotics have been introduced in manufacturing environments to reduce physical strain on workers, thereby preventing musculoskeletal injuries. However, one of the challenges with AI-driven wearables is worker acceptance, as some employees may be reluctant to wear devices that continuously track their physiological data. To encourage adoption, companies must educate employees on the benefits of these technologies while ensuring that strict data privacy policies are in place.

Despite the numerous advantages of AI and automation in workplace safety, there are ethical and operational concerns that must be addressed. One of the main criticisms is the potential displacement of human safety professionals due to the increasing reliance on automated systems. While AI enhances efficiency, human oversight is still essential in interpreting AI-generated safety insights and making critical safety decisions (Zavaleta, 2025). Additionally, bias in AI algorithms remains a concern, as improperly trained models may fail to accurately assess safety risks for diverse workplace environments and employee demographics. Companies must ensure that AI systems are continuously trained and updated using diverse datasets to improve accuracy and reliability. Furthermore, governments and regulatory agencies must develop clear guidelines for AI-driven workplace safety, ensuring that automation complements human safety efforts rather than replacing them entirely.

Looking ahead, the future of AI and automation in workplace safety management is expected to expand further with advancements in robotics, AI-driven safety coaching, and AI-assisted emergency response systems. AI-powered virtual safety assistants could soon provide real-time guidance to workers on safety protocols, while autonomous drones may be used to conduct remote safety inspections in hazardous environments. Additionally, the integration of quantum computing and AI in workplace risk modeling could enhance the accuracy of predictive safety analytics, allowing organizations to identify safety risks with even greater precision (Jeenath & Tamilpavai, 2025). However, achieving optimal AI integration will require collaborative efforts between companies, technology developers, and policymakers to ensure that AI-driven workplace safety solutions remain ethical, effective, and accessible across industries.

Conclusion

The findings of this study highlight the significant role of digital communication tools in enhancing occupational health and safety (OHS) awareness. Digital platforms such as e-learning modules, virtual reality simulations, mobile applications, and AI-driven monitoring systems have transformed traditional safety training and communication methods, making them more engaging, interactive, and effective. These tools improve hazard identification, emergency preparedness, and real-time safety updates, ultimately reducing workplace accidents and improving overall compliance with safety regulations. However, despite their advantages, challenges such as digital illiteracy, high implementation costs, and privacy concerns still hinder their widespread adoption, particularly in small and medium-sized enterprises (SMEs). Addressing these issues will be crucial in ensuring equitable access and effectiveness of digital OHS solutions across various industries.

While digital communication tools provide significant improvements in workplace safety, their success depends on proper implementation, regulation, and acceptance. Organizations must establish clear policies on digital safety communication, ensuring that all shared information is accurate, verified, and accessible to employees at all levels. Additionally, integrating AI-driven predictive analytics and automated risk assessments can further enhance workplace safety, but ethical concerns regarding employee surveillance and data privacy must be addressed. Governments and policymakers should consider providing incentives such as funding, tax benefits, or regulatory frameworks to encourage businesses especially SMEs to invest in digital safety solutions. Furthermore, comprehensive employee training programs should be developed to bridge the digital literacy gap and ensure that all workers can effectively utilize these tools.

For future research, it is recommended to explore the long-term effectiveness of digital OHS interventions across different industries and workplace settings. Future studies should also focus on evaluating employee perceptions and adaptability to digital safety technologies, as resistance to technological change remains a significant challenge. Additionally, research should investigate the role of artificial intelligence and machine learning in developing predictive safety models that can proactively identify and mitigate workplace risks. Comparative studies between traditional and digital safety training methods could also provide valuable insights into the most effective strategies for improving workplace safety culture. By addressing these areas, future research can contribute to the continuous evolution and optimization of digital OHS communication tools, ultimately fostering safer and healthier work environments worldwide.

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