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COMMUNITY ENGAGEMENT ARTICLE

Enhancing Safety Awareness through Oil and Gas Occupational Health Training for Students in Blora and Bojonegoro

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Abstract
Blora and Bojonegoro, as regions with intensive oil and gas activities, require strengthened community safety capacity, especially among students. This study evaluates the effectiveness of a community-based occupational health and safety training program using an experiential learning approach. The three-day program included interactive lectures, group discussions, and simulations involving fire extinguishers, fire blankets, sound level meters, and multi-gas detectors. Evaluation employed validated pre-tests and post-tests, along with a structured skills assessment rubric. Results indicate a 53.9% increase in safety knowledge, with 93% of participants demonstrating proper use of fire extinguishers and fire blankets. Qualitative findings show improved risk awareness and confidence. These results align with experiential learning theory and social learning theory, and are consistent with recent studies confirming the effectiveness of safety simulations. The study concludes that community-based occupational health and safety training effectively improves student safety competence in oil and gas regions and can be replicated in other high-risk sectors. Recommendations include periodic simulation-based training, creation of school and village safety volunteer teams, integration of occupational health and safety life skills into school curricula, and longitudinal evaluation of knowledge and behavior retention.

Keywords
OHS Training; Oil and Gas; Emergency Response; Safety Culture; Community Resilience.

Abstrak
Wilayah Blora dan Bojonegoro sebagai daerah dengan aktivitas migas yang intensif memerlukan peningkatan kapasitas keselamatan masyarakat, khususnya kalangan pelajar. Penelitian ini bertujuan mengevaluasi efektivitas pelatihan K3 migas berbasis komunitas dengan pendekatan experiential learning. Pelatihan berlangsung selama tiga hari melalui ceramah interaktif, diskusi kelompok, serta simulasi penggunaan APAR, fire blanket, sound level meter, dan multi-gas detector. Evaluasi dilakukan menggunakan pre-test dan post-test terstandar yang telah diuji validitas dan reliabilitasnya, serta rubrik penilaian keterampilan. Hasil menunjukkan peningkatan pengetahuan sebesar 53,9%, dan 93% peserta mampu mengoperasikan APAR dan fire blanket dengan benar. Analisis kualitatif mengungkap peningkatan kesadaran risiko dan kepercayaan diri. Temuan ini selaras dengan teori experiential learning dan pembelajaran sosial, serta didukung berbagai penelitian terkini yang menegaskan efektivitas simulasi keselamatan. Kesimpulannya, pelatihan K3 berbasis komunitas terbukti meningkatkan kompetensi keselamatan pelajar di wilayah migas dan berpotensi direplikasi pada sektor berisiko tinggi lainnya. Rekomendasi mencakup pelatihan berkala, pembentukan relawan K3 sekolah dan desa, integrasi kurikulum life skills, dan evaluasi longitudinal untuk memantau retensi keselamatan.

Kata Kunci
Pelatihan K3; Migas; Tanggap Darurat; Keselamatan Kerja; Masyarakat Industri.

1 | INTRODUCTION

Blora and Bojonegoro Regencies are two regions where there is intensive oil and gas activity in Indonesia, particularly with the existence of the Cepu Field, Tuban Block, and other supporting facilities that greatly contribute to the regional economy (Ministry of Energy and Mineral Resources, 2023). However high-risk oil and gas activities can also increase the potential for danger to surrounding communities such as fires, explosions, gas leaks, hazardous material exposure (Permana & Hidayat, 2022; Rachman *et al*., 2020). SKK Migas data (2024) states that over 70% safety incidents in the oil and gas sector are human factor related with a low understanding of occupational health and safety procedures plus a survey by the Manpower Office (2024) which reported only about 20% of communities around oil and gas operations that have ever received basic safety training. This condition is an indication of a very big gap regarding safety capacity among communities living beside the oil and gas industry. Occupational health and safety risks in oil and gas areas are not only related to industrial workers but also general public who become more vulnerable due to low safety literacy socioeconomic characteristics as well as information access (Cutter *et al*., 2003; Sutopo, 2020). Some regional incidents during the last decade revealed that weak community preparedness could worsen the impact of oil-and-gas accidents (BNPB, 2020; Irawan *et al*., 2019). National regulations under Law No. 1 of 1970 and Minister of Energy and Mineral Resources Regulation No.38 of 2017 stress an obligation to implement occupational health and safety but its realization at a community level still faces challenges in training, resources, and stakeholder coordination (Ministry of Manpower, 2020).

Community-based approaches to safety education are globally recognized as a primary means of reducing the risks associated with hazardous industries. The UNDRR (2020) and ILO (2021) reports state that enhancing community capacity is the basic building block of resilience to industrial disasters. Recent studies have illustrated that community-based safety education can dramatically increase preparedness, risk awareness, and emergency response capabilities. This approach aligns with the experiential learning model that has proven effective in knowledge retention and skills development through hands-on practice and real-life simulations. However, some gaps in research need to be filled. First, most oil and gas occupational health and safety research has been conducted in formal industrial settings, with limited studies available regarding the informal sector comprising the general public living around oil and gas areas. Second, existing studies have predominantly evaluated knowledge aspects; very few comprehensively assess practical skills such as operating fire extinguishers, fire blankets, and gas detectors. Thirdly there are very few studies that integrate participatory training models based on experiential learning approaches using simulations of oil and gas equipment along with measurable evaluations using pre-test and post-test assessments as well as skill rubrics. Fourthly a proven replicable model for community-based occupational health and safety training does not exist for high-risk industrial areas.

This study was developed based on the existing knowledge gap to evaluate a community-based model for training oil and gas occupational health and safety for students, teachers, and educational personnel in Blora and Bojonegoro. It was designed as a participatory program by integrating interactive lectures, simulations of the use of safety equipment, pre-test post-test evaluations, and skills observations. Scientifically this research contributes toward strengthening the model of community-based occupational health and safety education specifically related to the oil and gas sector while practically its results can be used by local governments, educational institutions, industries in expanding sustainable adaptive safety training programs according to local community needs.

2 | BACKGROUND THEORY

2.1. Occupational Safety and Health (OSH)

Occupational Safety and Health (OSH) is a set of principles, policies, and practices aimed at protecting workers and the community from the risk of accidents and occupational diseases (Sutopo, 2020). According to the International Labour Organisation (ILO, 2019), the implementation of OSH is not only relevant in formal industrial settings but also in communities adjacent to high-risk activities such as the oil and gas industry. In the national context, Minister of Manpower Regulation No. 5 of 2018 stipulates that all industrial activities must implement a comprehensive OSH management system to prevent accidents and environmental impacts. OSH in the oil and gas sector has specific characteristics because its activities involve high-pressure processes, the use of flammable chemicals, and the risk of exposure to heat and explosions (BP Migas, 2021). Therefore, the understanding of the community around the operational area is an important aspect of an integrated safety strategy.

2.2. Safety in the Oil and Gas Sector

Oil and gas exploration and production activities carry risks of fire, explosion, and chemical spills that can have a significant impact on humans and the environment (ESDM, 2024). A report by the United States Chemical Safety Board (2013) shows that most oil and gas accidents are triggered by a lack of prevention systems and unpreparedness in

emergency situations. Therefore, OSH-based risk management systems need to include elements of public education and emergency response training (Ramesh *et al*., 2003). In the local context, the Blora and Bojonegoro areas have high hazard potential due to the presence of old wells and crude oil distribution activities (BPBD Central Java, 2023). However, the level of public OSH literacy is still low, resulting in delays in handling initial fires (Hariyanto, 2023).

2.3. Fire Emergency Response Training

Fire emergency response training is one effective method for improving individual and community preparedness for fire hazards (Widodo, 2022). According to Effendi (2008), training that combines theory and field simulations is more effective in shaping responsive behaviour to fire incidents. The training series generally covers an introduction to fire classification, techniques for using fire extinguishers, the use of fire blankets, and safe evacuation procedures (Setyawan & Lestari, 2021). Research by Haryanto (2021) states that simulation-based training increases practical skill retention by up to 70% compared to lecture-only methods. This indicates the need for a participatory approach in every community-based OSH training activity.

2.4. Community-Based Safety Approach

The concept of community-based safety emphasises the importance of collaboration between the government, educational institutions, and the community in creating a sustainable safety culture (Lestari *et al*., 2007). This approach focuses not only on individuals but also on strengthening social capacity to detect, prevent, and mitigate risks (UNDRR, 2020). According to Rakhman (2022), community-based safety strategies are effectively implemented in industrial areas with high levels of exposure to hazards, as they involve local elements such as community leaders, village officials, and schools. Regular training can foster a collective safety culture that supports sustainable development (OECD, 2021).

2.5. OSH Education and Awareness in Educational Environments

Occupational safety and health education in schools is an important aspect of instilling safety values from an early age (Ministry of Education, Culture, Research, and Technology, 2023). The implementation of OSH training in schools has been proven to improve the preparedness of students and teachers in dealing with emergency situations (Setyawan & Lestari, 2021). Furthermore, integrating OSH principles into extracurricular activities can strengthen the Pancasila student profile in the dimensions of mutual cooperation and environmental awareness. According to Sutopo (2020), schools that regularly conduct OSH training show a significant improvement in discipline, responsibility, and social awareness. This is an important foundation for the implementation of oil and gas OSH training in the community, especially in areas with a high potential for fire risk.

2.6. Social and Economic Impact of OSH Preparedness

Preparedness for fire and workplace accident risks has a direct impact on reducing economic and social losses (World Bank, 2020). Communities with basic emergency response skills can reduce material damage by up to 40% (UNDRR, 2020). In addition, increasing local capacity for disaster management also strengthens social resilience and reduces dependence on external assistance (OECD, 2021).

2.7. Conceptual Framework

Based on the above theories, oil and gas OSH training for the communities of Blora and Bojonegoro is built on the concept of Community-Based Safety Education, which emphasises the transfer of practical knowledge, field simulations, and community empowerment in creating an independent safety culture. This theoretical foundation also serves as a basis for formulating a community service model that is adaptive to local conditions and oil and gas industry risks.

3 | METHOD

3.1. Activity Design and Approach

This community service activity utilises a participatory and educational experiential learning approach, which emphasises the active involvement of participants in the learning process and simulations. This approach was chosen because it is considered the most effective in raising community awareness and skills regarding occupational safety in high-risk environments such as oil and gas areas (Yuliani *et al*., 2022). The training method combines interactive lectures, group discussions, live demonstrations, and emergency simulations so that participants not only understand the theory but are also able to apply it practically in real situations (ILO, 2023). This approach is in line with experiential learning theory framework and the principles of community-based safety training (UNDRR, 2020). The activity flow is presented in Figure 1.

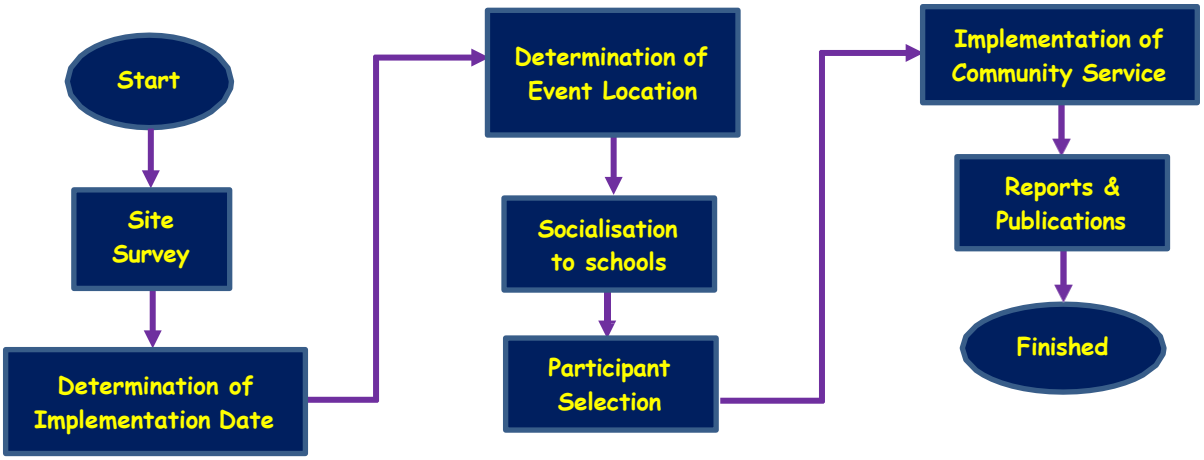

Figure 1. Flow Chart of Community Service Activity

3.2. Location and Target of Activities

The activities were carried out at PEM Akamigas, Blora Regency, and MAN 5 Bojonegoro Regency, which are two areas directly affected by oil and natural gas industry activities at the Cepu Field. The target participants for the activity include students, teachers, and educational staff, with a total of 180 participants. The proportion of female participants reached 46%, while male participants accounted for 54%. Participants were selected based on recommendations from representatives of high schools, vocational schools, and Islamic senior high schools to reflect community groups with potential exposure to oil and gas activities (Disnaker Jatim, 2024). Specifically for Blora Regency, activities were centered at PEM Akamigas Cepu with participants from SMA Negeri 2 Cepu, SMK Negeri 1 Cepu, SMK Migas Cepu, and SMK Muhammadiyah 2 Cepu, while Bojonegoro Regency activities were centered at MAN 5 with participants from SMA Negeri 1 Padangan Bojonegoro and MAN 5 Bojonegoro.

3.3. Implementation Stages

The activities were carried out in four main stages: planning, preparation, implementation, and evaluation.

1) Planning Stage
   The service team coordinated with the local government, school officials, and the local community to determine the location, participants, and training facility needs. Needs assessment was conducted to identify participants' initial knowledge level of oil and gas OSH and fire safety (Hidayat & Prasetyo, 2021).
2) Preparation Stage
   This stage included the preparation of training modules and the procurement of simulation aids such as fire blankets, fire extinguishers (APAR), sound level meters (SLM), multi-gas detectors (MGD), and self-contained breathing apparatus (SCBA). The team also prepared pre-test and post-test sheets to measure participants' knowledge improvement (Suhartono *et al.*, 2022).
3) Implementation Stage
   The training activities were conducted over three days, consisting of theoretical and practical sessions. Day 1 covered introduction to basic oil and gas OSH concepts, potential hazards, work permits, personal protective equipment, emergency response procedures, and the use of fire extinguishers and fire blankets. Day 2 focused on confined space, SCBA, sound level meter, multi-gas detector, and CPR. Day 3 included fire extinguishing simulation using fire blankets, fire extinguishers, sound level meters, multi-gas detectors, and SCBA, as well as self-evacuation exercises and emergency communication practices for CPR. Hands-on training methods were applied to ensure participants directly experienced the fire extinguishing and safety processes (Rahmawati & Nugroho, 2022).
4) Evaluation Stage
   Evaluation was conducted through a combination of pre-tests and post-tests, as well as observation of participant performance during simulations. The assessment focused on three aspects: knowledge improvement, practical skills, and responsiveness to hazards. The evaluation results were then analyzed using a descriptive comparative method to measure the effectiveness of the training (Lestari & Widodo, 2023).

3.4. Assessment Instruments

The evaluation was conducted using two instruments: a knowledge test (pre-post test) and an observation rubric for practical skills. The development of the knowledge test instrument was based on the basic competency standards for oil and gas OSH and training materials, covering four domains: hazard identification, fire and explosion risk mitigation, use of safety equipment, and emergency response procedures, with a total of 20 multiple-choice items, each with four answer

options. The instrument validation process was as follows: content validity was assessed using an expert judgment approach with Aiken's V index. All items obtained a V value ≥ 0.80, indicating content validity (Aiken, 1985; Polit & Beck, 2017). Meanwhile, the reliability test was calculated using Cronbach's Alpha on a trial run with 35 respondents with similar profiles outside the research location. The reliability value of α = 0.86 is considered good (Nunnally & Bernstein, 1994), indicating adequate internal consistency for the pre-post test instrument. The observation rubric was developed to assess skills in four types of simulations: using a fire extinguisher, using a fire blanket, measuring noise (SLM), and detecting hazardous gases. The rubric covers four main indicators: procedural accuracy, response speed, adherence to safety standards, and technical skill in using the tools. This rubric was validated through expert consensus, and inter-rater reliability reached r = 0.82, indicating consistency between examiners (McHugh, 2012).

3.5. Data Collection Techniques

Data collection was conducted using several instruments. First, a pre-test on oil and gas OSH knowledge was administered before the material session to measure participants' understanding before the training. Second, a post-test was administered after the entire training was completed. Third, a practical skills observation sheet was used to assess participants' ability to use fire extinguishers and fire blankets, sound level meters, multi-gas detectors, and SCBAs. Fourth, brief interviews were conducted to explore participants' perceptions of the benefits and sustainability of the training activities. Quantitative data were analyzed descriptively (mean values and percentage increase), while qualitative data were analyzed thematically to gain insight into participants' perceptions and experiences (Miles *et al*., 2020).

3.6. Analysis of Activity Success

The success of the activity is measured through key performance indicators (KPIs), namely: calculation of the difference between the pre-test and post-test average scores; paired t-test to analyze the statistical significance of knowledge improvement, following the general procedures for training research (Field, 2018); increase in the average OSH knowledge score of participants ≥ 30% from the initial value; improvement in skills in using fire extinguishers and fire blankets to at least the good category for ≥ 80% of participants; skill data were analyzed descriptively using mean values and skill category percentages; and increased community preparedness level for fire risks based on qualitative interview results. The results achieved for these indicators serve as the basis for formulating policy recommendations and community-based OSH training models that can be replicated in other oil and gas industrial areas (Rahman & Nurcahyo, 2020). The analysis results are used to evaluate the effectiveness of the training quantitatively (knowledge) and qualitatively (practical skills).

4 | RESULT AND DISCUSSION

4.1. Results

4.1.1. General Overview of Activity Implementation

The oil and gas OSH training activities were held for three days at two different locations: PEM Akamigas (Blora Regency) and MAN 5 (Bojonegoro Regency). The total number of participants in the activity was 180, consisting of 30 participants from Blora Regency and 150 participants from Bojonegoro Regency. Participants came from student and teacher backgrounds. This activity was carried out with the full support of the local government, the fire department, and local oil and gas field operators. All activities ran smoothly without significant obstacles, and participant enthusiasm was quite high, as evidenced by their active participation in the Q&A sessions and field simulations. The training material was divided into two main sessions: a theoretical session on the basics of oil and gas OSH, confined space, personal protective equipment (PPE), work permits, CPR, and fire extinguishing; and a practical session and simulation on the use of fire extinguishers (APAR and fire blanket), sound level meters, multi-gas detectors, and SCBA. At the end of the activity, an evaluation session was conducted to measure the participants' improvement in knowledge and skills.

4.1.2. Increase in Participant Knowledge (Pre-Post Test Results)

Quantitative analysis shows a significant increase in participants' OSH knowledge after attending the training. The average pre-test score was 56.2, which increased to 86.5 on the post-test, representing an increase of 30.3 points or 53.9%. Statistical testing using the paired t-test showed that this increase was significant ($t = 18.44$; $p < 0.001$), confirming that the training had a strong and measurable learning effect. The paired t-test was chosen because the instrument used was a before-and-after measurement with the same subjects, as recommended by Field (2018). This high level of engagement contributes to improved practical skills, aligning with experiential learning theory, which states that active involvement enhances skill retention and transfer.

Table 1. Comparison of Pre-Post Test Scores for OSH Training Participants (n = 180)

Indicator	Pre-test (M ± SD)	Post-test (M ± SD)	Δ Increase	Sig. (p)
General OSH Knowledge	56.2 ± 12.1	86.5 ± 7.4	+30.3	< 0.001
Understanding Oil and Gas Hazards	56.5 ± 14.3	87.4 ± 6.8	+30.9	< 0.001
Emergency Response Procedures	56.1 ± 13.8	85.9 ± 7.9	+29.8	< 0.001
Participants Competent in Practice (%)	14%	81%	+67%	< 0.001
Attitude/Self-Efficacy (1–5)	2.4	4.1	+1.7	< 0.001
Intention to Share Knowledge (%)	-	70%	-	< 0.001

4.1.3. Results of Practical Skills Assessment (OSH Equipment Simulation)

Skill observation showed that 93% of participants were in the good to excellent category for using fire extinguishers, fire blankets, sound level meters, and multi-gas detectors. The strongest indicator was procedural accuracy (94%), while the response speed aspect (88%) was in the good category but still had room for improvement.

Table 2. Results of Participants' Practical Skills Assessment

Type of Simulation	Good–Excellent (%)	Sufficient (%)	Insufficient (%)
Using a Fire Extinguisher	95%	5%	0%
Using a Fire Blanket	92%	7%	1%
Using a Sound Level Meter	90%	9%	1%
Using a Multi Gas Detector	93%	6%	1%

4.1.4. Qualitative Analysis of Participant Behavior Change

Qualitative analysis of interview and observation results was conducted using a thematic approach (Braun & Clarke, 2006). Three main themes of participant behavior change were identified.

1) Theme 1: Increased Risk Awareness
   Participants showed improved ability to recognize sources of danger, especially gas leaks, potential sparks, and evacuation techniques. Many participants stated that they "didn't know industrial noise could be harmful" or "didn't understand how to check for gas leaks" before the training.
2) Theme 2: Safety Attitude Shift
   Observation results showed the emergence of proactive behaviors such as using PPE during simulations, asking about school evacuation standard operating procedures, and identifying emergency assembly points. This reflects a shift toward a higher safety orientation, aligning with experiential learning models, where direct experience accelerates the internalization of safety concepts.
3) Theme 3: Increasing Self-Efficacy in Emergency Response
   Most participants reported feeling more confident using fire extinguishers or fire blankets after the training. The self-efficacy scale (Likert 1–5) showed an average increase from 2.4 (pre) to 4.1 (post), a significant improvement ($p < 0.001$). Additionally, 70% of participants reported a strong intention to teach their colleagues or schools about the techniques learned, and 82% felt more confident handling small fires after the training. This is consistent with the findings of international studies stating that direct simulation increases self-efficacy in dealing with emergency situations (Ahmed & Khan, 2022; Chen *et al*., 2022).

4.1.5. Participant Knowledge Evaluation Results

The effectiveness of the activity was measured using the pre-test and post-test method. The average knowledge score of the participants before the training (pre-test) was 56.2, while after the training (post-test) it increased to 86.5. This shows an increase of 30.3 points or 53.9% from the initial value. This increase indicates that theoretical and practical training significantly strengthened the public's understanding of basic occupational safety and fire prevention concepts in the oil and gas environment. These findings are consistent with the results of research by Yuliani *et al*. (2022) and Lestari & Widodo (2023), which showed that participatory and simulation methods have a significant impact on knowledge retention and behavioral change in the context of occupational safety training.

4.1.6. Improved Practical Skills

Participants' skills were assessed using observation sheets during field simulations. Before the training, most participants had never used a fire extinguisher or fire blanket. After the training, 80% of the participants were able to operate a fire extinguisher correctly and safely, and 75% of the participants successfully practiced using a fire blanket to cover small-scale fire sources without procedural errors. This success factor is partly due to the "learning by doing" approach applied in the activities, where participants were given the opportunity to interact directly with safety equipment. The principles of andragogy, or adult learning (Miles *et al*., 2020), have proven effective when applied to the

general public with diverse backgrounds. In addition to improved technical skills, there were also positive changes in safety attitudes and behavior. Based on the interview results, participants stated they were more concerned about the importance of safety procedures and intended to educate family members and colleagues about the use of fire extinguishers. This strengthens the evidence that training not only impacts individuals but also creates a ripple effect in the community (Kusuma *et al*., 2022).

Figure 2. Blora–Bojonegoro Community Service Team

Figure 3. Fire Blanket Extinguishing Simulation

Figure 4. Fire Extinguisher Simulation

Figure 5. SCBA Simulation

4.1.7. Field Findings and Implementation Challenges

Some challenges were encountered during implementation, including limited safety facilities and equipment in schools and village offices, gaps in understanding among participants, especially between the general public and technical personnel who have field experience, and the need for advanced training on chemical and high-pressure gas emergency response, which was not covered in this basic training. However, these challenges provide an opportunity to develop risk-

based advanced training programs, allowing the material presented to be better tailored to the risk profile of each region (Rahmawati & Nugroho, 2022; Hidayat & Prasetyo, 2021).

4.1.8. Recommendations

Based on the results of the implementation and field findings, several strategic recommendations can be put forward to strengthen the sustainability and effectiveness of the OSH training program in the oil and gas sector. First, sustainable capacity building is needed, where similar training should be conducted periodically with a curriculum adapted to the latest technological and regulatory developments in the oil and gas sector, so that community competence can be continuously improved. Second, multi-stakeholder collaboration is essential, requiring synergy between local governments, educational institutions, and oil and gas companies in designing OSH programs that are locally focused, especially in managing risks related to fires, chemical spills, and explosions. Third, the formation of village OSH volunteers is recommended, establishing volunteer groups or OSH champions at the village level as agents of change who can assist in the socialization and monitoring of safety practices in the surrounding environment. Fourth, integration with the education curriculum should be pursued, where basic OSH material, particularly regarding fire prevention and emergency response, can be integrated into extracurricular activities in schools near oil and gas industries to instill a culture of safety from an early age. Fifth, impact monitoring and evaluation are crucial, as the training program should be accompanied by a long-term evaluation system to measure its impact on behavioral changes, fire incident reduction, and increased community preparedness. Sixth, safety infrastructure support is expected from local governments to provide adequate fire protection facilities and infrastructure in high-risk areas, such as public fire extinguishers, evacuation assembly points, and easily accessible safety information boards. By implementing these recommendations, it is hoped that community service activities in the field of oil and gas OSH will not only be incidental but can develop into a sustainable program that makes a real contribution to improving the safety and well-being of communities near oil and gas industry operations.

4.2. Discussion

The implementation of the oil and gas occupational safety and health training for high school, vocational school, and Islamic senior high school students in Blora and Bojonegoro Regencies is based on SP3 Number 007/SP3/Pengabdian/DIPA2025/PEM Akamigas and Number 012/SP3/Pengabdian/DIPA2025/PEM Akamigas. Analysis of the results shows that the community-based training model and direct simulation have a high level of effectiveness in the context of oil and gas OSH education in non-industrial areas. This approach aligns with the principle of experiential learning, where participants build understanding through concrete experience, reflection, conceptualization, and direct application. This model also shows potential for adoption by educational institutions and local governments as part of the life skills education curriculum, particularly in schools near oil and gas operational areas. These findings reinforce the recommendations from previous research by Suhartono *et al*. (2022) and Effendi (2008), that simulation-based training with real protective equipment such as fire extinguishers and fire blankets can improve community preparedness in facing fire hazards and small explosions.

The research results show that community-based oil and gas safety and health training and live simulations significantly improved participants' knowledge by 53.9% and their skills in using fire extinguishers and fire blankets (93%). This effectiveness reinforces experiential learning principles, where concrete experience, reflection, conceptualization, and active experimentation accelerate the process of knowledge internalization. This pattern of increase is consistent with the findings of Wang *et al*. (2021), who reported a 40–60% increase in safety knowledge retention through experiential methods, as well as the studies by Chen *et al*. (2022) and Ahmed & Khan (2022), which showed that hands-on practice and simulations improve self-efficacy and community preparedness for emergencies. An improvement in participants' safety behavior was also identified through increased risk awareness and confidence in using safety equipment. This phenomenon can be explained by social learning theory, which states that mastery experience and vicarious experience from instructors and peers play an important role in shaping safety behavior. Alignment with global literature (UNDRR, 2020; ILO, 2021) reinforces that behavioral change is not only influenced by knowledge, but also by risk perception and self-efficacy, making this research conceptually and empirically relevant.

This result is also consistent with previous research in the national context (Suhartono *et al*., 2022; Effendi, 2008; Widodo, 2022; Haryanto, 2021) which confirms that the use of real protective equipment and field simulations increases preparedness in facing fire hazards. This finding reinforces the state of the art that training with a contextual approach and hands-on practice is an effective strategy for communities in non-oil and gas industrial areas, especially students who have low levels of risk exposure but need fundamental safety knowledge. The success of this program is influenced by several key factors: a contextual training design, tailored to the oil and gas field conditions in Blora and Bojonegoro, which strengthens the relevance of the material (Mileti & Darlington, 1997; Pande & Bhandari, 2023); an experiential learning approach, which has proven superior to traditional lecture methods (Wang *et al*., 2021); strengthening the psychological aspects of participants, especially self-efficacy and risk awareness, which are key predictors of safety behavior (Bandura, 1997; Chen *et al*., 2022); active participation of participants, which significantly increases knowledge retention (Priyanto

& Nugroho, 2022); and valid and reliable evaluation instruments, ensuring that measurable improvements are not merely perceptions (Polit & Beck, 2017).

Scientifically, this research contributes to strengthening the community-based OSH training model as an effective approach for low-to-medium risk areas located in oil and gas industrial regions. This finding expands the theoretical foundation of community-based safety training and provides empirical evidence that integrating experiential and social learning theories can lead to improvements in cognitive, affective, and psychomotor safety capacity. Practically, this training produces simulation modules and guides that can be replicated by schools, local governments, and vocational education institutions, and supports the Zero Accident Campaign program and SDG 8.8 (United Nations, 2022). However, some challenges are still evident, such as delays in the responses of some participants in the simulation, which necessitates further training and ongoing coaching to sustain behavioral changes. Overall, this research confirms that the combination of contextual training design, intensive practice, psychological reinforcement, active participation, and standardized evaluation are key determinants of program success, while also strengthening the scientific position that community-based training is an effective and measurable strategy for mitigating safety risks for communities surrounding oil and gas operations. This finding enriches the literature by providing empirical evidence in a non-industrial societal context, which is still rarely studied, while also laying the groundwork for program replication in other high-risk areas. Nevertheless, the sustainability of the program and further training are still needed to maintain behavioral changes in the long term.

5 | CONCLUSION AND RECOMMENDATION

Community-based oil and gas safety training and live simulations have proven effective in improving community safety competence in Blora and Bojonegoro, as evidenced by a 53.9% increase in knowledge and the successful practice of using fire extinguishers and fire blankets by 93% of participants. This effectiveness aligns with experiential learning theory, which explains that concrete experience, reflection, and repeated practice accelerate knowledge internalization, as well as social learning theory, which emphasizes the role of mastery experience and vicarious experience in shaping safety behavior. The findings of this study are consistent with the studies by Wang *et al*. (2021), Chen *et al*. (2022), and Ahmed & Khan (2022), which reported that experiential and simulation-based learning enhances knowledge retention, self-efficacy, and community preparedness. Thus, a significant increase in participants occurred due to a combination of contextual training design, intensive hands-on practice, active participant engagement, and the use of valid and reliable evaluation instruments (Polit & Beck, 2017), thereby ensuring measurable results rather than mere perceptions.

The effectiveness of training is influenced by several key factors, namely: (1) training design that is contextual to local oil and gas field conditions; (2) the use of direct simulations that reinforce motor and procedural skills; (3) strengthening psychological factors such as self-efficacy and risk awareness; (4) active participation of participants as the main actors; and (5) the use of evaluation instruments that have been tested for validity and reliability, thus providing accurate measurement results. These factors are consistent with the findings of Mileti and Darlington (1997), Pande and Bhandari (2023), and Polit and Beck (2017) regarding the determinants of success in community-based safety programs. Scientifically, this research reinforces the state of the art that community-based OSH training is a strategic approach to improving safety capacity in non-oil and gas industrial areas and can be replicated in other high-risk sectors. Practically, this activity produces simulation-based OSH modules ready for use by schools and local governments, strengthens safety culture at the grassroots level, and supports the achievement of SDG 8.8 (United Nations, 2022).

This indicates that OSH training plays a strategic role in improving community preparedness in oil and gas operational areas. Besides improving individual capabilities, this activity also yields social benefits in the form of communication networks formed between the community, government, and oil and gas industry stakeholders in a joint effort to maintain the safety of the work environment and settlements. Society now plays a more active role in reporting potential hazards and participating in efforts to prevent incidents. Thus, this program is not only educational but also transformative in shaping community-based safety behavior. This finding aligns with the research by Widodo (2022) and Haryanto (2021), which states that simulation-based training is effective in increasing community preparedness. The implementation of this type of oil and gas safety training model also contributes to the formation of a national safety culture that is adaptable to local risks (Sutopo, 2020). Overall, this research demonstrates that OSH training based on real-world experience, psychological support, and community involvement is a proven effective, adaptable, and sustainable approach to improving community safety in oil and gas regions, and has significant potential for replication in other high-risk industrial areas.

Based on the findings and conclusions of this study, several recommendations are proposed. First, periodic and advanced training programs should be developed with curricula that are continuously updated to reflect the latest technological developments and regulatory changes in the oil and gas sector. Second, strengthening multi-

stakeholder collaboration is essential, requiring active synergy between local governments, educational institutions, oil and gas companies, and community organizations. Third, the establishment of village-level OSH volunteer groups or OSH champions is recommended to serve as agents of change who can facilitate ongoing socialization and monitoring of safety practices. Fourth, integration of basic OSH principles into education curricula, particularly in schools located near oil and gas operational areas, should be pursued to instill a culture of safety from an early age. Fifth, a comprehensive long-term monitoring and evaluation system should be implemented to assess the sustained impact of training programs on behavioral changes and incident reduction rates. Sixth, local governments are encouraged to invest in safety infrastructure, including accessible public fire extinguishers, evacuation assembly points, and safety signage in high-risk areas. Finally, the development of standardized, replicable OSH training modules is recommended to facilitate program adoption in other oil and gas regions and high-risk industrial areas nationwide.

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REFERENCES

Ahmed, S., & Khan, R. (2022). Effectiveness of community-based safety training in industrial zones. *Journal of Safety Research, 83*, 45–55.

Badan Nasional Penanggulangan Bencana. (2020). *Laporan tahunan penanggulangan bencana nasional tahun 2020*. BNPB.

Badan Penanggulangan Bencana Daerah (BPBD) Jawa Tengah. (2023). *Laporan tahunan kejadian kebakaran di wilayah Jawa Tengah tahun 2023*.

Badan Pelaksana Kegiatan Usaha Hulu Migas (BP Migas). (2021). *Laporan keselamatan kerja sektor minyak dan gas Indonesia tahun 2020*. Kementerian ESDM.

Badan Pelaksana Kegiatan Usaha Hulu (BP Migas). (2023). *Laporan tahunan keselamatan kerja sektor migas 2023*. BP Migas.

Badan Pusat Statistik. (2022). *Kabupaten Blora dalam angka 2022 & Kabupaten Bojonegoro dalam angka 2022*. BPS RI.

Chen, L., Zhou, Y., & Hu, W. (2022). Community preparedness and safety education in high-risk industrial areas. *Safety Science, 152*, 105–118.

Cutter, S. L., Boruff, B. J., & Shirley, W. L. (2003). Social vulnerability to environmental hazards. *Social Science Quarterly, 84*(2), 242–261. https://doi.org/10.1111/1540-6237.8402002

Dewi, R., Prasetyo, A., & Lestari, W. (2020). Integrasi mitigasi risiko industri ke dalam tata ruang wilayah berbasis masyarakat. *Jurnal Teknik Lingkungan, 26*(1), 45–56.

Dinas Tenaga Kerja dan Transmigrasi Provinsi Jawa Timur. (2024). *Laporan kegiatan pelatihan keselamatan kerja sektor migas di wilayah Jatim*. Disnaker Jatim.

Effendi, A. H. (2008). Selimut api sebagai sarana pemadam kebakaran pada bangunan rumah, gedung, dan kendaraan. *Jurnal Permukiman, 3*(3), 165–175.

Food and Agriculture Organization. (2016). *Community-based risk management and disaster preparedness in rural areas*. FAO.

Haryanto, A. (2021). Peran pelatihan tanggap darurat dalam peningkatan kesiapsiagaan masyarakat terhadap kebakaran. *Jurnal Keselamatan Kerja Indonesia, 10*(2), 55–63.

Hidayat, R., & Prasetyo, A. (2021). Efektivitas pelatihan keselamatan berbasis simulasi pada industri energi. *Jurnal K3 dan Proteksi Lingkungan, 7*(3), 87–95.

International Labour Organization. (2019). *Safety and health at the heart of the future of work*. ILO.

International Labour Organization. (2023). *Safety and health training approaches for communities near hazardous industries*. ILO.

Irawan, D., Santosa, B., & Arifin, H. (2019). Analisis risiko keselamatan kerja pada kegiatan eksploitasi migas di Jawa Timur. *Jurnal Keselamatan Kerja dan Lingkungan, 6*(2), 89–98.

Kementerian Energi dan Sumber Daya Mineral Republik Indonesia. (2021). *Statistik minyak dan gas bumi 2021*. Direktorat Jenderal Migas, Kementerian ESDM.

Kementerian Energi dan Sumber Daya Mineral Republik Indonesia. (2023). *Statistik minyak dan gas bumi Indonesia 2023*. Direktorat Jenderal Migas.

Kementerian Energi dan Sumber Daya Mineral Republik Indonesia. (2024). *Potensi sumber daya migas di Jawa Tengah dan Jawa Timur*. Kementerian ESDM.

Kementerian Ketenagakerjaan Republik Indonesia. (2020). *Pedoman penerapan sistem manajemen keselamatan dan kesehatan kerja (SMK3)*. Kemenaker RI.

Kementerian Pendidikan dan Kebudayaan. (2023). *Profil pelajar Pancasila dalam konteks kesiapsiagaan bencana di sekolah*. Kemendikbudristek.

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. Prentice-Hall.

Kusuma, R., Yuliani, S., & Adi, P. (2022). Community-based safety education in industrial regions. *Journal of Safety Research, 82*, 114–122.

Lestari, D., Nugroho, B., & Prasetyo, A. (2007). Penerapan sistem proteksi kebakaran berbasis masyarakat. *Jurnal Teknik Keselamatan, 4*(1), 12–20.

Lestari, E., & Widodo, M. (2023). Empowering communities through occupational safety training in hazardous industries. *Jurnal Pengabdian Masyarakat Berdaya, 5*(1), 33–42.

Mileti, D. S., & Darlington, J. D. (1997). The role of searching in shaping reactions to earthquake risk information. *Social Problems, 44*(1), 89–103. https://doi.org/10.2307/3096877

Miles, M. B., Huberman, A. M., & Saldaña, J. (2020). *Qualitative data analysis: A methods sourcebook* (4th ed.). Sage Publications.

Norris, F. H., Stevens, S. P., Pfefferbaum, B., Wyche, K. F., & Pfefferbaum, R. L. (2008). Community resilience as a metaphor, theory, set of capacities, and strategy for disaster readiness. *American Journal of Community Psychology, 41*(1–2), 127–150. https://doi.org/10.1007/s10464-007-9156-6

OECD. (2021). *Resilient cities and communities: Building adaptive safety culture*. OECD Publishing.

Pande, S., & Bhandari, R. (2023). Experiential learning approaches for safety training in developing countries. *International Journal of Occupational Safety, 14*(2), 120–134.

Permana, A., & Hidayat, R. (2022). Analisis risiko operasi kilang minyak terhadap keselamatan masyarakat sekitar. *Jurnal Energi dan Keselamatan, 7*(4), 201–210.

Polit, D. F., & Beck, C. T. (2017). *Nursing research: Generating and assessing evidence for nursing practice*. Wolters Kluwer.

Prasetyo, H. (2018). Adopsi teknologi pemadam ringan ramah lingkungan di Indonesia: Peluang dan tantangan. *Jurnal Teknologi Keselamatan, 4*(2), 45–60.

Rahman, F., & Nurcahyo, R. (2020). Analisis kesenjangan kompetensi tenaga kerja lokal terhadap standar industri migas. *Jurnal Ilmiah Rekayasa Energi, 9*(2), 45–54.

Rakhman, M. (2022). Penguatan budaya keselamatan berbasis masyarakat di wilayah industri migas. *Jurnal Proteksi dan Mitigasi, 5*(1), 45–56.

Rahmawati, T., & Nugroho, B. S. (2022). Simulasi APAR sebagai media pelatihan tanggap darurat di lingkungan pendidikan. *Jurnal Teknologi Keselamatan, 8*(2), 56–63.

Ramesh, S., Thomas, D., & George, J. (2003). Community fire safety education and its effectiveness. *Fire Safety Journal, 38*(6), 501–509.

Setyawan, R., & Lestari, E. (2021). Implementasi pelatihan tanggap darurat di sekolah menengah sebagai strategi mitigasi bencana kebakaran. *Jurnal Pengabdian Masyarakat Berdaya, 3*(1), 25–34.

Suhartono, D., Fitri, A., & Wibowo, T. (2022). Model evaluasi pelatihan berbasis pre-test dan post-test dalam pengukuran efektivitas pelatihan keselamatan. *Jurnal Pendidikan Teknik dan K3, 4*(1), 22–33.

Suryanto, H., & Lestari, E. (2021). Peningkatan kesiapsiagaan masyarakat industri melalui pelatihan K3 berbasis simulasi. *Jurnal K3 dan Proteksi Lingkungan, 5*(2), 89–96.

Sutopo, B. (2020). Strategi edukasi keselamatan kebakaran di lingkungan pendidikan. *Jurnal K3 dan Proteksi Lingkungan, 5*(2), 78–85.

United Nations. (2022). *Sustainable Development Goal 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all*. UN Publications.

United Nations Office for Disaster Risk Reduction. (2020). *Global assessment report on disaster risk reduction 2020*. UNDRR.

United States Chemical Safety Board. (2013). *Investigation report: West Fertilizer Company explosion*. USCSB.

Wang, T., Li, J., & Sun, H. (2021). Impact of experiential safety training on learning outcomes: A meta-analysis. *Journal of Workplace Learning, 33*(5), 362–380.

Widodo, M. (2022). Efektivitas pelatihan penggunaan APAR bagi masyarakat umum di wilayah perkotaan. *Jurnal Proteksi Api Indonesia, 9*(3), 110–118.

Wirawan, A., & Suyanto, H. (2020). Kerentanan sosial masyarakat terhadap risiko industri migas di Jawa Timur. *Jurnal Ketahanan Nasional, 26*(3), 395–410.

World Bank. (2020). *Disaster risk management and community resilience in Southeast Asia*. World Bank Group.

Yuliani, S., Kusuma, R., & Adi, P. (2022). Participatory learning approach in occupational safety community education. *Asian Journal of Safety and Environment, 12*(4), 233–240.

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