

Development of Occupational Safety and Health Guidelines Using Quick Response Code on Land Measuring Tools for Students Vocational

¹Muhammad Nur Fuad*, ²Rini Kusumawardani, ²Eko Supraptono, ²Yeri Sutopo,
²Sri Handayani

¹Universitas Negri Malang, Malang, Indonesia

²Universitas Negri Semarang, Semarang, Indonesia

*Corresponding Email: muhammadnurfuad.fv@um.ac.id

ARTICLE INFO

ABSTRACT

Article history

Received: Apr 16, 2025

Revised: Sep 06, 2025

Accepted: Sep 15, 2025

Keywords

Guide

Occupational Safety and Health

QR Code

Land Survey

Vocational High School

In 2023, Indonesia recorded 370,747 work accident cases across various sectors, with the construction sector contributing the highest percentage at 40%. Many accidents are caused by limited understanding and low compliance with Occupational Safety and Health (OSH) procedures. Improving OSH understanding can be achieved through education, especially in vocational schools. SMK Negeri 3 Semarang has implemented an independent curriculum with a teaching factory system, but there is still no systematic OSH guide for soil measurement learning. Therefore, this study aims to develop a more structured and innovative QR Code-assisted OSH guide for soil measurement. This research used the Research and Development (R&D) method with the ADDIE model. The sample consisted of 70 Phase E students from the Construction and Housing Engineering program. Data analysis included validation by material experts and media experts to determine feasibility, practicality tests through teacher and student questionnaires, and effectiveness tests using pretest and posttest results. The data were first tested for normality and homogeneity before being analyzed using the T-Test and N-Gain test. The results showed that both material and media expert validations reached 91%, while the practicality test scored 92%. The effectiveness test produced an N-Gain score of 79%, categorized as effective. These findings indicate that the QR Code-assisted soil measurement OSH guide is feasible, practical, and effective in improving students' understanding and implementation of OSH procedures.

This is an open access article under the [CC-BY-SA](https://creativecommons.org/licenses/by-sa/4.0/) license.



Introduction

Occupational safety and health (OSH) is an important aspect that needs to be considered in the work environment. This is supported by Law Number 1 of 1970 concerning occupational safety which explains the industry's obligations to ensure a safe work environment including the provision of training, personal protective equipment, and safety procedures that must be followed by workers (Republik Indonesia, 1970). In 2023, Indonesia recorded 370,747 cases of work accidents which show significant challenges in the implementation of occupational safety in various sectors Kementerian Ketenagakerjaan, (2024).

Data in 2019 explains that the number of work accidents in the construction sector reaches 40%, which is included in the high number of work accidents (Indonesia Safety Center (ISC), 2024). Many accidents occur due to lack of understanding and non-compliance with safety procedures Prameswari and Cahyadi, (2024). OSH primary focus includes the tools used, the processes implemented, and their users. Every tool used in the job should be properly designed and maintained to minimize the risk of accidents. A systematic and planned work process also contributes to the reduction of potential hazards that can threaten the health of workers Ikhtiar et al., (2024). In addition, the role of workers in complying with OSH standards and adopting safe behaviors is essential to creating a conducive and safe work environment (Moosa et al., 2020; Hasibuan et al., 2020).

In an effort to improve occupational safety, one way that can be done is through education and training (Mahawati et al., 2021; Sastrini et al., 2023). Vocational High Schools have a very important role in increasing understanding of the importance of OSH. Vocational schools are designed to provide education that focuses on practice and direct application in the industrial world so that students not only learn theory but also gain experience and skills relevant to the needs of the world of work Noor et al., (2019). This is in line with Law Number 20 of 2003 concerning the National Education System Article 15 explaining that the purpose of vocational education is to prepare students to become skilled and competent workers in various fields of expertise Republik Indonesia, (2003).

Vocational schools not only prepare students with relevant technical skills but also equip them with an understanding of the importance of occupational safety Ahmad and Susilawati, (2023). A good understanding of OSH in learning at vocational schools, it is hoped that students can play an active role in creating a safe and productive work environment. Adequate education is essential to equip prospective workers with the knowledge and skills necessary in the implementation of occupational safety Vatankhah Barenji et al., (2024). With a curriculum that prioritizes

competencies and skills, they can adapt quickly in the work environment to meet the demands of the world of work and contribute effectively in various fields Sutjipto, (2019).

SMK Negeri 3 Semarang has implemented an independent curriculum and a teaching factory learning system that prioritizes practice-based learning in accordance with the world of work. Students are introduced to how to complete a job, either that produces products or services by paying attention to the OSH aspect Prianto et al., (2019). In the Independent Curriculum, researchers found that the OSH learning process is integrated into each element of the practical subject to support work according to the recommended procedures. Not to be outdone in learning to measure soil, the application of OSH also requires serious attention. In the Phase E soil surveying learning element, the expected learning outcomes are that students are able to understand the types of measuring instruments, how to operate, maintain manual and digital measuring instruments and calculate measurement data from the results Badan Standar Kurikulum dan Asesmen Pendidikan, (2022).

Soil surveying activities involve the use of tools with specific specifications and techniques that can be harmful if not done with the correct procedures Muzayanah and Budianto, (2020). In addition, soil measurements are often carried out in open areas that have difficult terrain conditions, such as slopes, muddy soils, and shrubs Kucukarslan et al., (2023). In the learning of land surveying in the Construction and Housing Engineering expertise program, the expected OSH practice is still not optimal due to the lack of understanding, teaching materials, and clear guidelines. From the observations made, the researcher found that there was no systematic OSH guide for soil measurement in learning which resulted in teachers being forced to explain the material manually. This has an impact on the implementation of OSH in the field, where students who often have difficulty participating in learning without a clear reference to the expected implementation.

Teachers who teach soil surveying materials also stated that there is a lack of knowledge and application of OSH among students and a lack of interesting and accessible learning resources. This research aims to develop a guide that not only educates students on soil measurement techniques, but also emphasizes the importance of OSH in vocational education settings. The use of QR Codes in this OSH guide allows students to access additional information interactively and in real time, thereby increasing understanding in the application of OSH while working in the field.

Method

This research uses the Research and Development (R&D) method with the ADDIE development model which consists of five stages of analysis, design, development, implementation, and

evaluation Sugiyono, (2020). This research focuses on the development of OSH guidelines for QR Code-assisted soil surveying materials for students of SMK Negeri 3 Semarang. The population of this study includes 70 students of Phase E of Construction and Housing Engineering who are in the control class and 35 students in the experimental class. The sampling technique used is total sampling, where the entire population is sampled to get representative results. Data was collected through expert assessment sheets, student and teacher questionnaires, as well as pretests and posttests. Figure 1 is a model of the research conducted.

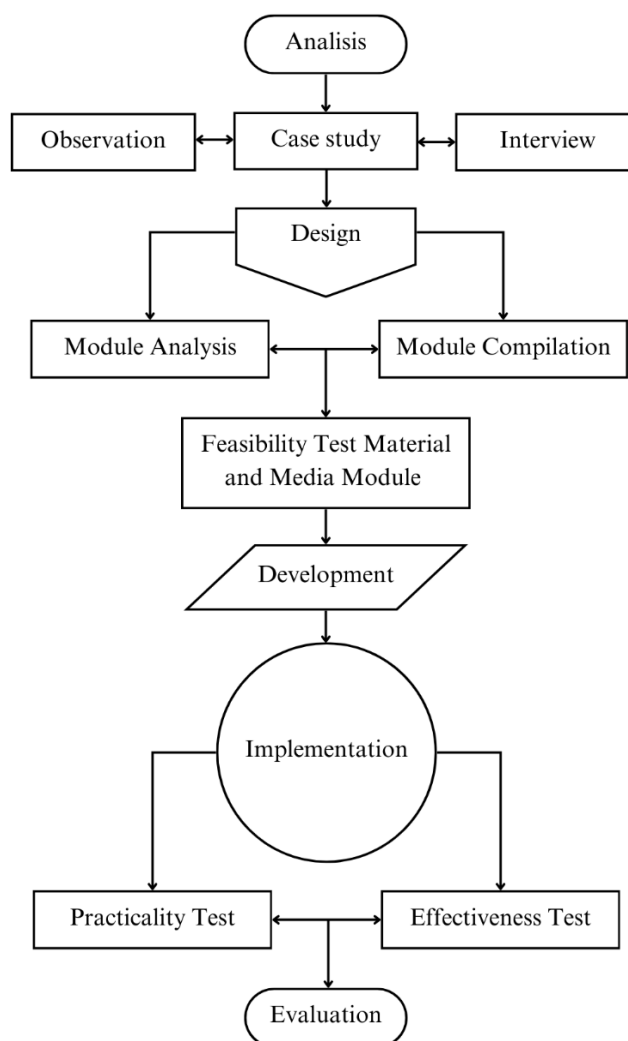


Fig 1: R&D Research Model

In the analysis stage, the researcher identifies problems and analyzes student needs. Data was collected through direct observation and interviews with teachers. In the design stage, the researcher designed a QR Code-assisted OSH guide by considering occupational safety principles

that are in accordance with soil surveying practices. The development stage is carried out by involving validators who are experts in materials and media. Subject matter expert validation focuses on content accuracy and curriculum suitability, while media expert validation evaluates aspects of the display, readability, and comprehensibility of the guide. The implementation stage is carried out by applying OSH guidelines in learning activities on soil surveying practices in Phase E of Construction and Housing Engineering SMK Negeri 3 Semarang. Students of the experimental class used the OSH guide in the practice of soil surveying, while the control class learned without using the guide. Implementation was followed by data collection through a questionnaire to assess students' responses to the use of the guidance and their knowledge related to OSH. The last stage is an evaluation conducted by collecting data from the results of the pretest and posttest to measure the effectiveness of the OSH guidelines.

Eligibility Testing OSH guidance using media member assessment instruments and materials. The validation results were analyzed using Aiken's V Index to assess the consistency of expert assessments with a minimum value of 0.4 as a feasibility criterion with a sufficient category and an Intraclass Correlation Coefficient (ICC) to assess the reliability between validators with a minimum criterion of 0.5 indicating moderate reliability Babu and Kohli, (2023). After the guidelines were declared feasible, the researcher tested the practicality of the guidelines through questionnaires given to teachers and students. The practicality analysis used the Scalability Coefficient with a minimum value of 0.6 and the Reproducibility Coefficient with a minimum value of 0.9 Nazir, (2005). Effectiveness testing uses the Pretest and Posttest scores of students in the experimental and control classes. Previous data has gone through analysis requirements tests including (1) Normality Test and (2) Homogeneity Test. The analysis of effectiveness test data used Independent Sample T-Test analysis which was used to determine the significance of the difference in learning outcomes between the experimental class and the control class Sudaryono, (2016). The results of the T-Test with a value of more than 0.05 showed a significant difference between the two groups. In addition, the calculation of N-Gain to assess the improvement of student understanding with the criteria in the following table according to Arikunto (2014) in Table 1.

Table 1. Interpretation of the Effectiveness OSH Guidelines

Value	Interpretation
> 76	Effective
56 - 75	Quite Effective
40 - 55	Less Effective
< 40	Ineffective

Result and Discussion

Research Results

The researcher designed a guide with a systematic structure, covering four main chapters, namely Introduction to Occupational Safety and Health (OSH), OSH in Soil Surveying, Personal Protective Equipment (PPE), and Safe Work Procedures in Soil Surveying Learning. The guide design also comes with additional QR Code elements that contain additional explainer videos, illustrative images, and relevant case studies. This aims to enable students to access additional materials interactively and understand the application of OSH in practice in a more real way. This guide on figure 2 has a standard size of 15.5 x 23 cm according to UNESCO standards, making it easy for students to carry and learn. Figure 2 is a display of the OSH guide in question.



Fig 2: OSH Guide Product Exterior Display

The development stage involves a validation process by subject matter experts and media experts to evaluate the feasibility of content and display. The researcher conducted development by improving several parts of the material to better suit the needs of students. One of the developments carried out is to clarify instructions regarding the use of personal protective equipment (PPE) in soil surveying practices with the addition of more specific images, such as examples of the use of

helmets, safety shoes, and reflective vests. In addition, an illustration of how to use the measuring instrument correctly was also given so that students could better understand safety procedures. The use of these images not only clarifies the material, but also makes the guide more interesting, and easy to understand. In addition, QR Codes are tailored to the learning needs of schools. QR Code is now directly connected to a video tutorial on soil surveying practices that fit the curriculum and real situations in the field. This video visualizes correct OSH practices in the use of measuring instruments such as total stations, theodolite, and flat spraying aircraft. The use of QR Codes also provides more accessibility for students to learn independently outside of class hours and enhances the interactive learning experience.

Feasibility Testing

The OSH guideline feasibility test was conducted by material experts and media experts with the average value of the validity test analyzed using the V Aiken index and reliability using ICC (Intraclass Correlation Coefficient) with the following results in Table 2.

Table 2. OSH Guide Feasibility Test Results

Items	Material Expert	Media Expert	Average	Ket
Aiken V Value	0.877	0.904	0.891	Very High
ICC Value	0.887	0.779	0.833	Good

The results of the feasibility test show that the assessment of the OSH guidelines by subject matter experts and media experts is in the very high category with a good level of reliability. This means that this guide is considered very feasible to use in learning because it has relevant content, an attractive appearance, and is reliable in its application. The validation data from the experts was then further analyzed using data tabulation to calculate the percentage of guideline eligibility. Based on this calculation, the feasibility percentage was obtained at 91%. This score indicates that the OSH guide of soil surveying materials falls into the category of being very feasible for use in learning soil surveying by students and teachers.

The feasibility test by material experts covers various important aspects in assessing the quality of learning materials, including the suitability and completeness of the material with the learning objectives to be achieved. The content of the material is structured in a clear, structured, and systematic manner, so that students can easily understand the concepts and procedures of OSH being taught. All topics necessary to achieve learning objectives have been covered without any confusing or irrelevant information.

The feasibility test by media experts focuses on the visual design and layout of the media used. The design of media covers is designed in an attractive way and in accordance with the learning context, so that it can attract students' attention and foster interest in learning more material. The media layout has been neatly arranged with the use of clear fonts, appropriate font sizes, and text arrangements that make it easier for readers to understand the content of the material. The use of color in this OSH guide has also been well noted, which is not too flashy but interesting enough to support understanding.

Practicality Test

The OSH guidelines were tested for practicality through questionnaires to students and teachers with an analysis of scalability coefficients and reproducibility coefficients. The results of the analysis show the following values in Table 3.

Table 3. OSH Guide Practicality Test Results

Items	Student	Teacher
Scalability Coefficient	0.798	0.846
Reproducibility Coefficient	0.916	0.933

The results of the practical test of the OSH guide for soil surveying materials based on the assessment of student and teacher users show that this guide can be applied well in learning. This is evidenced by the results of the test carried out by analyzing the Scalability Coefficient and Reproducibility Coefficient. The value of the Scalability Coefficient has been greater than 0.60, which indicates that the guide has a high applicability and is well adaptable in a variety of learning situations. In addition, the value of the Reproducibility Coefficient has a value greater than 0.90. This shows that guides can convey information consistently and reliably in the learning process. Further analysis with data tabulation shows that the percentage of practicality reaches 92%, which falls into the category of very practical. One of the main factors underlying this assessment is the ease of understanding the material presented in the guide. The material compiled in this guide uses simple, clear, and well-structured language, so that students can easily understand and follow each part of the material presented. These guides are designed in a lightweight and compact form, so they are easy to carry anywhere and store without taking up much space. It is not too large physical shape makes it practical to store in a bag or in a student's study room. This practicality is also supported by the existence of a technological element, namely the use of QR Code. The OSH guide equipped with a QR Code gives students direct access to additional resources such as video tutorials and more in-depth explanations relevant to the topic being studied. This feature allows students to learn in real-time, answer questions or difficulties they encounter during the learning process, and deepen

their understanding of the material.

Effectiveness Test

Before the previous data effectiveness test, the analysis requirements were tested with the results of (1) the normality test had a value greater than 0.05 with the following details in Table 4 and Table 5.

Table 4. N-Gain Normality Test Results

	Class	Shapiro-Wilk		
		Statistics	Df	Sig.
N_GAIN	Control	.963	35	.285
	Experiment	.949	35	.103

(2) The Homogeneity Test has a based on mean value greater than 0.05 with the following results on table 5.

Table 5. N-Gain homogeneity test results

Test of Homogeneity of Variances					
		Living Statistic	df1	df2	Sig.
N_GAIN	Based on Mean	.046	1	68	.830
	Based on Median	.044	1	68	.835
	Based on Median and with adjusted df	.044	1	67.631	.835
	Based on trimmed mean	.045	1	68	.833

After ensuring that the data meets the test requirements for analysis, it is followed by the Independent Sample T-Test. This test was conducted to find out if there was a significant difference between the learning outcomes of students in the control class and the experimental class. The results of the T-Test are as follows on table 6 and table 7.

Table 6. N-Gain T-Test Results

Independent Samples Test						
		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	Df	Sig. (2-tailed)
N_GAIN	Equal variances assumed	.046	.830	-16.841	68	.000
	Equal variances not assumed			-16.841	68.000	.000

Table 7. Effectiveness Test Results

Items	Control Class	Experiment Class
Average N-Gain Value	22.02	78.78
Minimum Value of N-Gain	0.00	53.33
Maximum Value of N-Gain	50.00	100.00
Percentage	22%	79%
Category	Ineffective	Effective

From the results of the large analysis, the percentage of the control group can be categorized as "Ineffective" because the average increase is relatively low which only reaches 22%. Meanwhile, the experimental group can be categorized as "Effective" because the average increase reached 79%.

Discussion

From the results of the study, it was found that OSH guidelines are very efficient in the learning process. Each section of the material is structured in a compact manner but still includes all the necessary information, so students don't have to spend a lot of time reading material that is too long or complicated. The learning process becomes more focused and effective, as students can immediately grasp the essence of the material without needing to get stuck in unnecessary information. In addition, this guide can also be used by students independently, giving them the freedom to learn at their own pace. This makes the guide very flexible, whether used in classroom learning or in learning activities outside the classroom or independently.

In the experimental class that used the posttest score guide, there was a significant increase when compared to the pretest score. This indicates that the guide is successful in helping students understand the material being taught and improving their competence and understanding of the topics being discussed. This significant increase in grades proves that the guide can not only be used practically, but also effective in improving the quality of student learning. On the other hand, the control class that did not use OSH guidance received only a slight improvement, but this figure was much lower compared to the experimental group. This suggests that without guidance, students in the control group have difficulty understanding the material and applying good OSH procedures.

From the results of the researcher's observations regarding the application of OSH students in practicing using OSH guidelines in learning soil measurement practices with total station aircraft, it shows a striking difference between students in the experimental class who use the guide and students in the control class. This can be seen from how students undergo their work safety procedures and responsibilities during practice. Students in experimental classes who use OSH

guidelines exhibit behaviors that better understand OSH procedures and discipline in maintaining safety, both towards themselves, the tools used, and the measurement process. They adhere to all the procedures that have been taught in the guide, such as wearing PPE completely from the beginning to the end of the practice session, without any negligence in removing or reinstalling the PPE during the measurement process. In addition, they also pay great attention to the cleanliness and safety of the tool, such as cleaning and storing the measuring tool after use which shows an attitude of responsibility and concern for the maintenance of the tool.

Students of the experimental class also show great concern for safety during practice, such as not eating or drinking during practice which is one of the important things to maintain concentration and avoid potential dangers that can occur due to negligence. They appear to be more organized and aware of their surroundings with a better focus on the task at hand and their job safety. This shows that the OSH guidelines they use are effective in forming a more cautious and responsible mindset towards safety, not only towards themselves, but also towards their colleagues and the environment around them.

Students in control classes who did not use OSH guidelines tended to be more labile and less attentive to small aspects of safety that are very important in soil measurement practice. Even though they undergo practice with the same tools, there are some instances where students of the control class are not fully aware of the potential dangers that can arise during practice, such as negligence in the use of PPE that is sometimes incomplete or detached during practice. Some students also seem to not understand the potential hazards that can increase the risk of appliance damage or safety issues later on. This difference illustrates the positive influence of the use of OSH guidelines that not only provide theoretical information, but also shape students' character and behavior in maintaining work safety.

The OSH guidelines have succeeded in creating a higher awareness of the importance of maintaining safety during practice which is reflected in the discipline of students in following safety procedures and understanding the slightest potential danger. In this case, the students' application of OSH in undergoing practice looks more structured, attentive, and responsible in the experimental class, while students in the control class still show negligence towards the safety procedures that should be carried out.

From the research and discussion, it is supported by opinions Lingard (2013) that the use of guidelines in practice in the field can improve student understanding. The OSH Guide provides clear and systematic direction regarding the steps to be taken to avoid the risk of accidents and hazards

during practice in the field. A good understanding of OSH can form awareness and a positive attitude towards the importance of maintaining the safety of oneself and others Antao et al., (2016). In addition, this in-depth understanding encourages students to be more compliant with established safety procedures, so that the risk of work accidents can be minimized. High compliance with the OSH guidelines also reflects students' responsibility to maintain a safe and conducive work environment, which has a positive impact on the smooth process of practical learning in the field Riani et al., (2022).

When compared to other technology based OSH learning methods such as Augmented Reality (AR) that require special devices and applications, QR Code based guides have the advantage of ease of access. This guide can be directly scanned using the camera or cam scanner feature on almost all android and non-android devices without the need for additional applications. More than that, the QR Code developed presents a real video of an example of the implementation of measurements in the field, instead of containing simple moving images or animations. The presence of the real video makes it easier for students to understand the correct procedures because they can see firsthand work practices that are in accordance with standards, so that the delivery of material becomes more applicative, realistic, and effective in building awareness and compliance with OSH.

Conclusion

The OSH guidelines developed have succeeded in fulfilling the aspects of occupational safety and health aspects in soil measurement practices by utilizing QR Code technology to improve accessibility and learning interactivity. Validation and trials show that this guide is feasible, practical, and effective to use in learning. This OSH guide is easy for students and teachers to use because it has clear guidelines, communicative language, and flexible QR Code features. The learning media used in the development of this guide has the potential to be generalized to other vocational subjects with a high risk of OSH, such as in the majors of machining, automotive, or building construction. By adapted to real video content, work procedures, and safety guidelines to their respective fields, this approach can be easily adapted without the need for complex additional infrastructure. This shows that the results of the research do not only have an impact on one subject, but also contribute to strengthening the awareness culture of OSH more broadly in vocational education. The researcher expressed his gratitude to the Institute for Research and Community Service of Semarang State University (UNNES) for providing financial support through the research scheme for masters of education students for the 2025 fiscal year. This assistance plays a very

important role in the smooth implementation of research and development of OSH guidelines carried out by researchers. It is hoped that the results of this research can make a positive contribution to the development of learning in Vocational High Schools, especially in increasing student awareness and compliance with the implementation of OSH in the field.

References

- Ahmad, M., & Susilawati. (2023). Penerapan budaya keselamatan dan kesehatan kerja (K3) di laboratorium pendidikan kimia Madrasah Aliyah Negeri (MAN) Pematang Siantar. *Jurnal Ilmu Komputer, Ekonomi, dan Manajemen (JIKEM)*, 3(2), 2734–2741.
- Antao, P., Calderon, M., Puig, M., Michail, A., Wooldridge, C., & Darbra, R. M. (2016). Identification of occupational health, safety, security (OHSS) and environmental performance indicators in port areas. *Safety Science*, 85, 266–275. <https://doi.org/10.1016/j.ssci.2015.12.031>
- Arikunto, S. (2014). *Evaluasi program pendidikan*. Bumi Aksara.
- Babu, N., & Kohli, P. (2023). Commentary: Reliability in research. *Indian Journal of Ophthalmology*, 71(2), 400–401. https://doi.org/10.4103/ijo.IJO_2016_22
- Badan Standar Kurikulum dan Asesmen Pendidikan. (2022). *Capaian pembelajaran mata pelajaran dasar-dasar teknik konstruksi dan perumahan fase E untuk SMK/MAK*. Kemendikbudristek.
- Hasibuan, A., Purba, B., Marzuki, I., Sianturi, M. E., Armus, R., Gusty, S., Sitorus, M. C., Khariri, Bachtiar, E., Susilawaty, A., & Jamaludin. (2020). *Teknik keselamatan dan kesehatan kerja*. Yayasan Kita Menulis.
- Ikhtiar, M., Imaduddin, F. M., & Fachrin, A. S. (2024). Hubungan program kesehatan dan keselamatan kerja (K3) dengan produktivitas kerja. *Higiene*, 10(1), 50–57.
- Indonesia Safety Center. (2024, October 2). *Kecelakaan kerja di Indonesia: Data, penyebab, dan upaya pencegahan*. Indonesia Safety Center (ISC).
- Kementerian Ketenagakerjaan Republik Indonesia. (2024). *Kecelakaan kerja tahun 2023*. In *Data prioritas ketenagakerjaan SDI 2023*.
- Kucukarslan, A. B., Koksall, M., & Ekmekci, I. (2023). A model proposal for measuring performance in occupational health and safety in forest fires. *Sustainability*, 15(20), 14729. <https://doi.org/10.3390/su152014729>
- Lingard, H. (2013). Occupational health and safety in the construction industry. *Construction*

- Management and Economics*, 31(6), 505–514. <https://doi.org/10.1080/01446193.2013.816435>
- Mahawati, E., Fitriyatunur, Q., Yanti, A. C., Rahayu, P. P., Aplilliani, C., & Chaerul, M. (2021). *Keselamatan kerja dan kesehatan lingkungan industri* (R. Watrionthos & J. Simartama, Eds.). Yayasan Kita Menulis.
- Moosa, M. M., Oriet, L. P., & Khamaj, A. M. (2020). Measuring the causes of Saudi Arabian construction accidents: Management and concerns. *International Journal of Occupational Safety and Health*, 10(2), 108–114. <https://doi.org/10.3126/ijosh.v10i2.33282>
- Muzayanah, & Budianto, E. (2020). *Ilmu ukur tanah*. Unesa University Press.
- Nazir, M. (2005). *Metode penelitian*. Ghalia Indonesia.
- Noor, I. H. M., Sumantri, D., Irmawati, A., & Juanita, F. (2019). *Revitalisasi SMK dalam meningkatkan kompetensi dan keterampilan lulusan untuk memanfaatkan sumber daya alam lokal*. Pusat Penelitian Kebijakan Pendidikan dan Kebudayaan, Badan Penelitian dan Pengembangan, Kementerian Pendidikan dan Kebudayaan.
- Prameswari, H. D., & Cahyadi, N. (2024). Analisis penerapan keselamatan dan kesehatan kerja (K3) pada proyek konstruksi PT. XYZ di Kota Gresik. *Jurnal Manajemen Kompeten*, 7(1), 1–11.
- Prianto, A., Winardi, & Qomariyah, O. N. (2019). Pengaruh penerapan teaching factory dan keterlibatan dalam pembelajaran terhadap kesiapan kerja lulusan SMK. *Conference on Research & Community Services*, 1(1), 968–991.
- Republik Indonesia. (1970). *Undang-Undang Republik Indonesia Nomor 1 Tahun 1970 tentang keselamatan kerja*.
- Republik Indonesia. (2003). *Undang-Undang Republik Indonesia Nomor 20 Tahun 2003 tentang sistem pendidikan nasional*.
- Riani, E. C., Thoha, A., Amini, A., & Hijjah, N. (2022). Development of e-module K3 and employment law. *PROBILITAS*, 1(2), 4–8. <https://doi.org/10.54482/PROBILITAS/>
- Sastrini, Y. E., Pertiwi, G. H., & Khoiri, M. M. (2023). *Kesehatan dan keselamatan kerja: Tinjauan komprehensif*. Tahta Media Group.
- Sudaryono. (2016). *Metode penelitian pendidikan*. Prenada Media.
- Sugiyono. (2020). *Metode penelitian dan pengembangan*. CV Alfabeta.
- Sutjipto. (2019). Perancangan kurikulum sekolah menengah kejuruan sebagai pranata budaya kerja. *Jurnal Pendidikan dan Kebudayaan*, 4(1), 102–126.

Email : joves@mpv.uad.ac.id

Website : <http://journal2.uad.ac.id/index.php/joves>

Vatankhah Barenji, A., Garcia, J. E., & Montreuil, B. (2024). A modular XR collaborative platform for occupational safety and health training: A case study in circular logistics facilities. *Information*, 15(9), 570. <https://doi.org/10.3390/info15090570>