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OPTIMIZING STUDENTS' UNDERSTANDING THROUGH THE USE OF OSH LAND MEASUREMENT GUIDELINES IN VOCATIONAL HIGH SCHOOL

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Abstract

Occupational Safety and Health (OSH) is essential in every field of work, especially in the construction sector, which has a high risk. One way to improve understanding of OSH is through learning when students carry out practices in vocational schools. This study aims to determine the extent of optimization of students' understanding through the use of OSH guidelines and evaluate the extent to which the use of OSH guidelines can improve student understanding. The study used a quantitative approach with a pretest and post-test design. This study involved 35 students as samples, namely students of class X TKP 2 of SMK Negeri 3 Semarang. The results showed that applying the OSH guide significantly improved students' understanding, with an average pretest score of 62.77 and a post-test of 92.06. The Paired Samples T-Test test yielded a p-value of 0.000, indicating a significant difference between the pretest and post-test scores. The ANOVA test results also indicated that students' response to the OSH guide significantly affected their improved understanding. These findings indicate that using OSH guidelines in learning land measurement practices effectively improves students' understanding and awareness of the importance of safety in the field.

Keywords: Understanding, Vocational High School, OSH Guide, Land Measurement

Introduction

Occupational Safety and Health (OSH) is crucial in every work sector. It is no exception in jobs with a high-risk level, such as the construction sector (Putri & Lestari, 2023; Prameswari & Cahyadi, 2024; Sinaga et al., 2022). Law Number 1 of 1970 on Occupational Safety requires a safe working environment with the provision of training, personal protective equipment (PPE), and safety procedures that must be followed (Republik Indonesia, 1970). However, OSH practices in the field sometimes show a different reality (Mahawati et al., 2021; Sastrini et al., 2023). In 2023, Indonesia recorded 370,747 cases of work accidents, with the construction sector accounting for about 40% of the total (Kementerian Ketenagakerjaan, 2024). These work accidents are primarily caused by a lack of understanding of safety procedures and non-compliance with OSH standards, leading to many accidents in the field (Mahawati et al., 2021).

Vocational High Schools (SMK), as educational institutions that prepare skilled workers, have a strategic role in integrating OSH education since students are at school. SMK should be at the forefront in equipping students with knowledge and skills about occupational safety that are applicable and relevant to the world of work (Al Hassany & Nurdin, 2024; Sari, 2023). SMK is designed to provide education that focuses on practice and direct application in the world of work so that students not only learn theory but also gain experience and skills that are relevant to the needs of the world of work (Noor et al., 2019; Dewanto & Hadi, 2022; Sobari et al., 2023). Law Number 20 of 2003 concerning the National Education System Article 15 explains that vocational education aims to prepare students to become skilled and competent workers in various fields of expertise (Republik Indonesia, 2003). With a curriculum emphasizing competence and skills, students are expected to adapt quickly to the work environment to meet the demands of the world of work and contribute effectively in various fields (Sutjipto, 2019; Suryana & Ismi, 2019). SMK prepares students with relevant technical skills and equips them with an understanding of the importance of work safety (Ahmad & Susilawati, 2023; Iriani et al., 2022).

SMK Negeri 3 Semarang, one of the educational institutions that has used the independent curriculum and teaching factory learning system, has tried to integrate OSH education in every practical subject. One of the building expertise programs is Construction and Housing Engineering (TKP). In this expertise program, students learn technical skills, one of which is land measurement, which involves the use of optical measuring instruments and other heavy equipment that has the potential to pose a risk if not carried out by the correct safety procedures (Muzayanah & Budianto, 2020). Although this curriculum already includes OSH material, in practice, the application of OSH in land measurement learning still faces obstacles, one of which is the lack of understanding and awareness regarding the importance of OSH implementation (Rizky et al., 2023; Ikhtiar et al., 2024).

From the observation, the researcher found students drinking near the optical ground measurement tool and not wearing project helmets. This shows a lack of awareness of the importance of personal and tool protection in risky work environments (Winarno & Andjarwati, 2019). Meanwhile, the haphazard placement of storage boxes for optical tools and other aids can cause danger and damage. The teacher teaching the land measurement material also stated that there was a lack of OSH knowledge and application among students due to the lack of interesting learning resources. A previous literature review related to OSH identified the lack of adequate teaching materials as one of the main obstacles to the application of OSH in schools (Riani et al., 2022).

In the OSH learning process, it has been oriented and collaborates with the world of work which aims to create graduates who are ready to use and relevant to market needs (Widiatma, 2019; Subijanto et al., 2019; Widiyanti & Prihantono, 2021). This is in line with the spectrum of SMK education, which explains that the learning outcomes of subjects refer to the learning outcomes set by the government in collaboration with industry (Kemendikbudristek Republik Indonesia, 2022). In the Phase E earth measurement learning element, the expected learning outcomes are

that students can understand the types of measuring instruments, how to operate and maintain professional and straightforward measuring instruments, and how to calculate measurement data (Badan Standar Kurikulum dan Asesmen Pendidikan, 2022). SMK collaborate with industry to provide practical training that complies with work safety standards set in the world of work (Hussain et al., 2021; Febriyana et al., 2023; Purnamawati & Yahya, 2019). This will support the regulation of Law Number 17 of 2023, which requires industries to assess future workers' physical and mental health (Republik Indonesia, 2023).

However, in the structure of the SMK curriculum, the OSH aspect in land measurement only gets a very limited portion. In fact, in practical learning such as land measurement, knowledge and application of OSH should be an integral and inseparable part. Therefore, the application of OSH must be seen as an essential complement in land measurement practices in schools. In the learning process at SMK 3 Semarang, the OSH guide used has been prepared and adjusted to the standards set by the Badan Nasional Sertifikasi Profesi (BNSP), so that it has a direct relationship with the needs and standards of the world of work. This strengthens the relevance between land measurement learning in schools and professional practice in the industry, where occupational safety is an important aspect in assessing the competence and readiness of the workforce.

This study aims to determine the extent to which the optimization of students' understanding of the land measurement field is achieved by using OSH guidelines in vocational education. In addition, this study also evaluates the extent to which OSH guidelines can improve students' understanding of mastering OSH material and practical skills in land measurement. It is expected that the results of this study can contribute to improving the quality of education in SMK and strengthening student competence in facing the challenges of the world of work in the land measurement sector.

Research Methods

This study used a quantitative approach conducted at SMK Negeri 3 Semarang by involving one group of students as a sample. The research sample consisted of 35 students with relatively similar characteristics so that the research results could represent the general condition of students in the expertise program. The research design used was a pre-test post-test group design, where before being given treatment, all students first took a OSH understanding test (pre-test) to determine their initial level of knowledge about OSH (Sudaryono, 2016; Singarimbun & Effendi, 2016). After the pre-test, students were given treatment in the form of applying OSH guidelines in the land measurement learning process, which included integrating the importance of work safety and applying OSH steps in each stage of the practicum. This OSH guide is used to create an effective and efficient learning environment so that students can be more focused and ready to undergo practicum activities (Syamsiah et al., 2021; Fuad et al., 2024; Vatankhah Barenji et al., 2024).

After the treatment, students took a post-test similar to the pre-test to measure the improvement of their understanding of OSH and land measurement materials (Sari, 2023). The data obtained from the pre-test and post-test were then analyzed using statistical tests. A normality test was conducted first to ensure data distribution, and then a Paired Sample T-Test was conducted to determine the difference between pre-test and post-test scores.

In addition, students' responses were also analyzed to determine their experience using the OSH guide during learning. This analysis involved a regression test to determine the effect. Student responses were used because they can explain how the OSH guide can affect users' understanding, either directly through improved test scores or indirectly through increased safety and confidence during practicum (Rosie et al., 2023). The following is the pre-test grid and student response questionnaire:

Table 1. Pre-Test and Post-Test Indicators

No	Aspects	Indicators	Sub Indicators
1	Understanding	Tools used	Types of PPE
			How to use and function
		Potential hazards in the field	Identify potential hazards
			Hazard handling
		OSH principles in soil surveying activities	Definition of OSH
			OSH Objectives
			the importance of OSH in work
			Basic principles of occupational safety
2	Application	Standard OSH procedures at the job site	First aid in work accidents
		Safe soil survey work procedure	Safety articles
			Emergency procedures

Table 2. Student Response Questionnaire Indicators

No	Aspects	Indicators	Sub Indicators
1	Material	Improving understanding and application of soil survey OSH	Knowledge of OSH
			Implementation of OSH procedures
			Understanding possible hazards
			Safety evaluation
		Device and user safety	Use of personal protective equipment
			Safety of using measuring instruments
			Maintenance of soil surveying instruments
			Secure storage of measuring instruments
2	Use	Habits of maintaining OSH	Discipline in following OSH procedures
			The importance of OSH evaluation
			Implementing a culture of safety
			Implementation of emergency response measures
		Ease of use	Ease of understanding of the guide
			Easy access to information
			The use of OSH aids in practice
			Speed in adaptation
3	Technology	Utilization of technology	Use of digital apps or devices

	Utilization of technology in risk monitoring
	Use of technology in security reporting
	Technology integration in OSH

The instruments used in this study include an OSH comprehension test consisting of multiple-choice questions, description questions, and essay questions to measure students' knowledge of OSH. The questions have been made in such a way with the level of difficulty referring to Bloom's taxonomy C1 (understanding) to C6 (evaluating) (Mahmudi et al., 2022). In addition, a student response questionnaire was used to assess the effectiveness of using the OSH guide in learning. This questionnaire measures the extent to which students find the guide helpful in understanding the OSH material (Najuah et al., 2020).

Research Results and Discussion

The study's results were explained quantitatively, referring to the comparison between students' pretest and post-test scores, which showed significant changes in students' understanding after applying the OSH guide (Sudaryono, 2016). In addition, descriptive analysis was used to explore the extent to which the application of the OSH guide can optimize student understanding in terms of increasing test scores and changes in the consistency of student understanding (Sugiyono, 2023).

In this study, the data obtained has gone through the analysis requirements test to ensure that the data meets the necessary assumptions before conducting further analysis. The normality test is carried out to determine whether the data distribution follows a normal distribution (Sugiyono, 2019). Based on the normality test results, the significance value (sig.) obtained is 0.153, which is greater than 0.05. This shows that the data is normal because the sig. Value is greater than the minimum value limit set.

In addition, the homogeneity test is also carried out to ensure that the variance between the groups being compared is homogeneous (Sugiyono, 2019). The homogeneity test results show a sig. Value based on a mean of 0.222, also greater than 0.05. This means that the variation between respondents is not significantly different, or in other words, the data is homogeneous. With the normality and homogeneity test results that meet the requirements, this study proceeds to the paired sample t-test and regression test stages to see the effect of using the OSH guide on student understanding.

Table 3. Average Test Score in the T-Test Sample Paired Test

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pretest	62.77	35	10.373	1.753
	Posttest	92.06	35	6.725	1.137

The table above shows descriptive statistics for the pretest and posttest scores of students who took part in learning using the OSH guide. The average pretest score is 62.77, which shows the level of student understanding before applying the OSH guide, while the average posttest score is 92.06, which shows an increase in student understanding after applying the OSH guide. This shows that using the OSH guide improves students' understanding of land measurement. In addition, the standard deviation for the pretest was 10.373, which indicates a considerable variation in students' understanding before learning.

However, after implementing the OSH guide, the standard deviation for the post-test decreased to 6.725, indicating that students' understanding became more consistent and uniform. The standard error of the pretest was 1.753, while that for the posttest was 1.137, indicating that

the posttest means more accurately reflected students' understanding after the OSH guided learning.

Table 4. T-Test Sample Paired Test Results

		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	Df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	Pretest - Posttest	-29.286	8.383	1.417	-32.165	-26.406	-20.668	34	.000

The Paired Samples T-Test test results showed a significant difference between students' pretest and post-test scores with a significance value (p-value) of 0.000, much smaller than the 0.05 significance level. This value indicates that applying OSH guidelines in learning land measurement significantly improves students' understanding. The average difference between the pretest and posttest scores is -29.286, indicating a significant improvement in students' understanding before and after applying the OSH guide.

In addition, the 95% confidence interval for the difference in scores was between -32.165 and -26.406, reinforcing that this difference was consistent across most of the sample. Thus, it can be said that using OSH guidelines effectively optimizes students' understanding of earth measurement materials in SMK, improving technical skills and emphasizing the importance of occupational safety and health in field practice (Waruwu et al., 2023).

Table 5. Linear Regression Test Results

Type	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.866a	.583	.093	5.870
a. Predictors: (Constant), Students'_Responses				

In this study, the correlation analysis in the regression test results is the same as the correlation test using Pearson Correlation, which shows a significant relationship between using OSH guidelines and increased student understanding. The coefficient of determination (R Square) of 0.583 or 58.3% indicates that using OSH guidelines has a considerable contribution to improving students' understanding of learning land measurement. This means that more than half of the increased understanding recorded can be explained by applying OSH guidelines, which include aspects of occupational safety and health in each practicum stage.

Table 6. ANOVA Combination

Type		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	154.389	1	154.389	4.480	.000b
	Residual	1137.154	33	34.459		
	Total	1291.543	34			
a. Dependent Variable: Increase						
b. Predictors: (Constant), Students'_Responses						

The ANOVA test results show that student responses have a significant influence on improving student understanding. The F value of 4.480 indicates that the variation explained by the regression model is quite significant compared to the variation that is not explained. With a significance value (Sig.) of 0.000, which is smaller than the significance level of 0.05, it can be said that the regression model used is highly statistically significant. This means that students' responses

to using OSH guidance as a predictor variable have a strong and significant relationship to improving students' understanding of learning land measurement. This result reinforces the finding that applying OSH guidelines reflected in students' response to learning is important in optimizing students' understanding, especially in improving their knowledge and skills in land measurement.

From the results of the above research, it can be explained that using OSH guidelines has a positive impact on improving students' understanding and awareness of OSH, as reflected in the increase in post-test scores and students' responses to learning. This finding answers the formulation of the problem: using OSH guidelines can improve students' understanding of learning land measurement and raise their awareness of the importance of OSH. The following is an integrated model of optimizing students' understanding through the OSH guide.

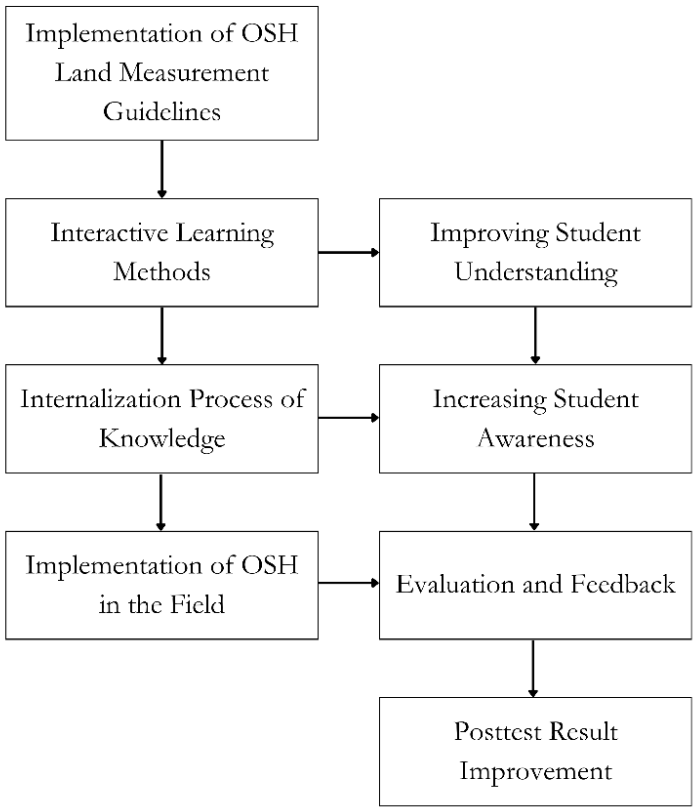

Figure 1. Integration Model for Optimizing Student Understanding

The results showed a significant difference between students' pretest and posttest scores. The average pretest score of students was 62.77, which showed that they understood the information before the treatment, while the posttest score increased significantly to 92.06 after using the OSH guide. The Paired Samples Test results showed a significance value of 0.000, which indicates that this increase in student understanding did not occur by chance but was the result of applying the OSH guide in learning. This shows that the OSH guide improved students' technical skills in land measurement and played an important role in increasing their awareness of OSH.

In addition, students' responses showing higher satisfaction and application of occupational safety during learning also support this finding. Students recognized that applying the OSH guide made them more careful in the practicum and better understood the importance of OSH measures during work. Thus, using OSH guidelines proved effective in improving students' understanding of land measurement materials and increasing their awareness of the importance of work safety.

This finding links the research results with the established knowledge structure regarding the importance of OSH integration in vocational education. In the context of technical and

vocational education (Suprayitno et al., 2021), the application of OSH is important to reduce the risk of work accidents and shape students' professional attitudes when they later enter the world of work. These results strengthen the argument that practical learning that integrates OSH aspects can improve the quality of students' competencies and prepare them to work more safely and responsibly (Hasibuan et al., 2020; Wibowo et al., 2022; Parashakti & Putriawati, 2020).

Conclusion

Based on the results of the analysis, it can be concluded that the use of OSH guidelines in learning land measurement in SMK has a significant positive impact on improving students' understanding and awareness of OSH. The application of the OSH guide has been proven to improve students' posttest scores, which indicates a better understanding of the earth measurement material and a better application of work safety. This finding shows the importance of integrating OSH aspects in engineering education to prepare students who are technically competent and aware of the importance of safety in the workplace. For further development, OSH guidelines can be applied in the entire learning process of productive practices in SMK to expand the application of work safety in various fields. Further research could focus on measuring the long-term impact of OSH implementation and students' work readiness in the world of work.

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