

Evaluation of learning occupational safety and environmental health in vocational schools

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Abstract

This research aimed to describe the implementation of occupational safety and environmental health (OSEH) learning by teachers in the construction and property technology expertise programme. This research was conducted at five Indonesian vocational high schools that held the construction and property technology expertise programme. The population of this research was all vocational high school students in South Sulawesi province. Based on the cluster random sampling technique, five schools were selected to be the research sample with a total of 270 students. The results showed that the implementation of OSEH learning was carried out extremely well by the teachers in all of the schools under study. However, only 20% of the students had adequate OSEH knowledge, which indicates the need for the improvement of their knowledge. While the students' attitudes towards the implementation of OSEH were generally good, they reported that their schools lacked personal protective equipment to be used during their practicum, thereby showing the need for more facilities.

Keywords: occupational safety, environmental health, vocational schools;

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1. Introduction

1.1. Conceptual framework

The preparation of labour that suits the needs of the world of work has become one of the challenges of vocational high schools. Vocational schools, as one of the institutions that prepare middle-level workforces according to the field of expertise, are expected to produce skilled graduates (Finch & Crunkilton, 1999; Sudana et al., 2019). Students are demanded to adjust and meet the needs of work demands in the industrial world.

Diversification of vocational school development is carried out to expand employment opportunities for vocational school graduates (Ali et al., 2021; Sutikno, 2014). It is oriented towards the types of expertise areas that are scattered and needed in the world of work. In vocational secondary education, the distribution of the areas of skills is referred to as the spectrum of vocational secondary education skills. This spectrum is the types of educational programmes and signs of their implementation as a reference in the establishment and development of educational programmes (Asrib & Arfandi, 2020).

One of the skill programmes in vocational schools is construction technology and property. This expertise programme is divided into modelling and information building design; construction and property business; irrigation and bridge road construction; and sanitation and maintenance building construction skills (Jaedun et al., 2020). In every expertise offered in vocational schools, occupational safety and environmental health (OSEH) becomes a significant competence for students to prevent any possible risks either mentally or physically in their future workplace.

1.2. Related research

OSEH learning is an effort to create a safe and comfortable working atmosphere. Essentially, this field of study within vocational schools is intended to ensure the health, safety and welfare of the students or graduates in the workplace (Andersson et al., 2015; Chatigny et al., 2012; Ismara et al., 2021). It also encourages students to maintain cleanliness and take care of their practicum workshops during their learning processes. Therefore, they must clearly understand the functions of the equipment under use. Furthermore, they are also expected to understand the importance of performing a standard operating procedure (SOP) as part of OSEH competence during their practicum to avoid work potential accidents or work-related illnesses. Unfortunately, students often underestimate the importance of this factor (Wahrini et al., 2019; Wijanarka et al., 2019).

Most of the causes of work accidents are derived from human factors and the lack of knowledge of occupational safety and health. It shows the reasons why teachers need to teach OSEH to maintain the welfare of students while working in school and the industrial world to avoid the risk of any possible work accidents or occupational diseases. This is particularly crucial to the extent that students will deal with materials and equipment with potential dangers (Mostafa & Momen, 2014; Wahrini et al., 2019).

1.3. Purpose of the study

Based upon the above-mentioned significance, learning in both theory and practice should familiarise students with the implementation of occupational safety and health. Within some schools in Indonesia, OSEH is, however, not offered separately as an independent subject yet, but is integrated into other subjects. Furthermore, the discussion related to occupational safety in the classroom is still mainly oriented towards the knowledge, or theory, aspect and has not focused on the habituation that is

needed to shape students' positive attitudes and practical skills. Therefore, the current research investigated the following questions:

1. How do the teachers implement OSEH in learning?
2. What is the students' knowledge of OSEH?
3. What are the students' attitudes towards OSEH?
4. Is there any significant relationship between the students' knowledge and attitude towards the implementation of OSEH?
5. What is the difference between male and female students' knowledge of OSEH?
6. Is there any significant difference in the attitude towards OSEH implementation between male and female students?

2. Method

2.1. Research approach and participants

This research was a descriptive correlational study using a quantitative approach. It was conducted in vocational high schools which organised the construction and property technology expertise programme in South Sulawesi province, Indonesia. There were 25 state schools in the population. Using Slovin's formula with a rate of 0.05, 5 schools with a total of 270 students were selected to be the research participants based upon a random cluster sampling technique. The five schools selected as samples were taken based on the location of the schools in the north, east, west, south and the capital city of South Sulawesi province.

2.2. Research variables

The variables under study included the implementation of OSEH as learning material, students' knowledge and students' attitudes towards OSEH learning. The implementation of OSEH learning in this case refers to the learning process of OSEH conducted by teachers in a school subject. Students' knowledge is the students' understanding of OSEH material. Students' attitude is the actions taken by students in the implementation of OSEH in the school environment.

2.3. Data collection tool and analysis

Research data were collected by the use of questionnaires distributed through an online Google Form. This research was conducted from March to May 2020. This study utilised the quantitative data analysis technique, with descriptive statistics used to analyse data by describing the data that had been collected. The study's free variables and bound variables were measured in the form of numbers and then the absence of influence or relationship between the two variables was described. Research data were analysed with a descriptive and inferential analysis with Statistical Package for the Social Sciences (SPSS) (version 22.0). The regression analysis was also employed to see the contribution of variables.

3. Findings

3.1. The implementation of OSEH

In the Indonesian context, subjects in vocational high school are grouped into five categories: A, B, C1, C2 and C3. Categories A, C1, C2 and C3 are all subjects that must be offered within both vocational and general high schools; all these subjects are managed by the central government. Category B includes all the subjects managed and developed by the local government. C1 subjects are a group of subjects that must be taken by all vocational school students within the same area of expertise, while C2 subjects

are required for all students who are in the same skill programme. C3 subjects are a group of subjects that must be studied by the students who are in the same skill competency.

The construction and property technology expertise programme is one of the programmes included in the subject of technology and engineering expertise. This programme consists of four competencies as shown in Table 1.

Table 1. Respondents' Skills Program

No	Expertise program	Frequency (%)
1	Construction of sanitation and building maintenance	1.03
2	Construction of irrigation and bridges	2.76
3	Modeling design and building information	85.86
4	Construction and property business	10.34

Modelling design and building information were found to be the most dominant competency given to the respondents, which accounted for 85.86%. The results showed that from all competencies studied, most subjects of groups C2 and C3 explained the material concerning OSEH. However, the results showed that the basics of building construction and soil measurement techniques was the subject that most dominantly discussed occupational safety and health lessons. This subject belonged to group C2.

It is important to note that, during the pandemic, the learning process was dominantly conducted through WhatsApp, followed by Zoom and Google Meet. Students also used mobile phones as a learning medium. For the Internet connection, they generally had their Internet connection in their phones, yet sometimes used Wi-Fi either in their own homes or in certain locations that provided free Internet access.

Table 2. Learning Implementation by Teachers

No	Learning implementation by teachers	Students' responses (%)	
		Yes	No
1	Teachers explain the objectives of OSEH	96	4
2	Teachers give the assignment for OSEH	91	9
3	Teachers give exam questions for OSEH	89	11

Based on Table 2, almost all students stated that their teachers explained OSEH within their classroom and provided students with assignments. However, 11% of the respondents reported that teachers did not give exam questions regarding OSEH. It shows that not all teachers gave specific questions measuring students' abilities related to OSEH. Occupational safety and health learning materials provided in the construction and property technology expertise programme are outlined in Table 3.

Table 3. Students' Responses on Learning Materials of OSEH

No	Learning materials of OSEH	Students' responses (%)	
		Yes	No
1	The principle of OSEH	93	7
2	Meaning and symbol of OSEH	86	14
3	The objectives of OSEH	91	9
4	The important role of OSEH on the work environment	94	6
5	The rules of OSEH	82	18
6	Sources of danger	88	12
7	Work accidents	94	6
8	Personal protective equipment (PPE)	96	4
9	Toxic and hazardous materials	62	38

No	Learning materials of OSEH	Students' responses (%)	
		Yes	No
10	Ergonomics	50	50
11	Cleanliness	91	9
12	Work environment	96	4
13	Construction safety management system	86	14

Table 3 shows that the teachers seemed to have covered all of the 13 lessons related to OSEH. Interestingly, for the toxic and hazardous materials, only 60% of the respondents stated that the material was given by their teachers and only 50% of the respondents stated that the teacher delivered the material in ergonomics.

3.2. Knowledge of OSEH

Students' knowledge of OSEH is measured using a multiple-choice test consisting of 13 materials delivered by the teacher, as shown in Table 3. The number of test items is 16, 2 of which were considered difficult, 12 medium and 2 easy. The power index of the question items is divided into 12 excellent items, 3 good items and 1 poor question item. The results of the OSEH test for vocational school students of the construction and property technology expertise programme are shown in Table 4.

Table 4. Knowledge Score on OSEH

No	Completion criteria	percentage
1	Students did not meet the completion criteria	79.31
2	Students meet the completion criteria	20.69

Table 4 shows students' knowledge of OSEH. The maximum score in this test was 100, and the minimum score was 0. The minimum completion criteria value was 70. The students' test results on OSEH showed that more than 79% of them still had a score below the minimum completion criteria. This indicates that teachers might need to measure students' understanding of the materials discussed in the class more often.

3.3. Students' attitude on the implementation of OSEH

The students' attitudes towards the implementation of OSEH were measured using an attitude scale instrument with four scales (very good, good, poor and very poor). The number of statements provided was 20. The measurement results are shown in Table 5.

Table 5. Students' Attitude on the Implementation of OSEH

No	Implementation of OSEH	Category (%)			
		Very good	Good	Poor	Very poor
1	Work environment	42	47	8	3
2	Personal protective equipment	36	43	16	5
3	Health	38	47	13	1
4	Cleanliness	39	45	13	2
5	Standard operating procedure	41	52	5	2

Table 5 shows that more than 20% of the respondents did not pay attention to PPE. More than 10% tended to ignore the aspects of the work environment, health and hygiene. Meanwhile, only 7% of the participants did not follow the SOP.

3.4. The relationship between students` knowledge and attitudes on the implementation of OSEH

The relationship between the students` knowledge and attitudes in the implementation of OSEH was analysed using SPSS. The results are presented in Table 6. It shows that the correlation value of the relationship between students` knowledge and attitudes in implementing OSEH was -0.062. It means that the current study found no relationship between students` knowledge and attitudes towards the implementation of OSEH.

Table 6. The Relationship between Students` Knowledge and Attitudes to the Implementation of OSEH

Control		Variables	Attitude	Knowledge
Group	Attitude	Correlation	1.000	-0.062
		Significance (2-tailed)	.	0.294
		df	0	287
	Knowledge	Correlation	-0.062	1.000
		Significance (2-tailed)	0.294	.
		df	287	0

3.5. Differences in Students` OSEH Knowledge by Gender

Table 7. Descriptive Statistics of the Value of Knowledge of Male and Female Students

	Group	N	Mean	Std. deviation	Std. error mean
Knowledge	Female	120	8.9583	2.95170	0.26945
	Male	170	9.1882	3.19205	0.24482

As shown in Tables 7 and 8, SPSS results showed that the number of male students was 170 and the number of female students was 120. The average value and standard deviation of male knowledge were higher than those of women. In comparison, the standard error value of the average female knowledge was greater than that of men. The test of the differences between the two is shown in Table 8.

Table 8. Hypothesized Test of Differences in Knowledge of Male and Female Students

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference	95% Confidence interval of the difference	
								Lower	Upper	
Knowledge	Equal variances assumed	1.447	0.230	-0.623	288	0.534	-0.22990	0.36902	-0.95621	0.49641
	Equal variances not assumed			-0.631	267.978	0.528	-0.22990	0.36406	-0.94669	0.48688

3.6. Differences in Students' Attitudes to the Implementation of OSEH by Gender

Differences in the students' attitudes towards the implementation of OSEH between male and female students are presented in Tables 9 and 10.

Table 9. Descriptive Statistics of the Attitudes of Male and Female Students on the Implementation of OSEH

	Group	N	Mean	Std. deviation	Std. error mean
Attitude	Female	120	64.0500	9.91887	0.90547
	Male	170	65.0882	9.31807	0.71466

SPSS results showed that the number of male students was 170 and the number of female students was 120. The average value of male attitudes was higher than that of women. In comparison, the standard value of the deviation of the women's attitudes was higher than that of men. The difference test between the two is shown in Table 10.

Table 10. Hypothetical test of Differences in Attitudes of OSEH Implementation of Male and Female Students

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference	95% Confidence interval of the difference Lower Upper	
Attitude Equal variances assumed	0.028	0.867	-0.910	288	0.364	-1.03824	1.14113	-3.28425	1.20778
Attitude Equal variances not assumed			-0.900	246.175	0.369	-1.03824	1.15352	-3.31027	1.23379

4. Discussion

4.1. The implementation of OSEH learning

OSEH learning is one of the basic competencies of the subjects taught in Indonesian vocational schools that are in categories C2 and C3. In subject C2, this competency is discussed in general and included as the basic part of construction safety. Nevertheless, in C3, it is explored more specifically and considered to be directly related to expertise competency.

Based on the research findings, it was found that more than 85% of the expertise competencies were run by vocational high schools with construction and property technology expertise programmes. This competency is a vocational school programme that has been implemented for 3 years. The dominant subjects explored OSEH in groups C2 and C3. During the pandemic, students generally accessed their learning materials on WhatsApp groups with the use of their smartphones.

In each lesson, nearly all of the respondents stated that the teachers taught the stages of OSEH effectively. Nonetheless, 11% of the respondents stated that the teachers did not provide an exam question concerning OSEH. Although almost all materials related to OSEH were delivered by the teachers, two of them had not been optimally discussed: toxic and hazardous materials (B3) and

ergonomics. Rahdiyanta et al. (2019) explained that OSEH becomes the basis of the theory to learn practical skills in the practicum workshops.

The implementation of OSEH in both theory and practical skills conducted by students should become the attention of teachers before allowing them to carry out any practicum in the workplace (Basori, 2018). The measurement of students' understanding and attitudes towards OSEH should be strictly enforced as a form of school attention to students' safety in industrial work practices. This is also one of the connectivity models between vocational high schools and the world of work (Ismara et al., 2019).

To prevent work accidents in the construction industry, the understanding of occupational safety and health in schools must be adjusted to meet the conditions in the workplace. This condition was carried out in schools in Denmark and Sweden (Grytnes et al., 2018). Grytnes et al. (2018) mentioned that the adjustment of learning in schools with conditions in the world of work provides a sense of security for students so that they can easily adapt to the work environment when they perform industry practices.

Gherardi (2009) stated that to understand safety practices they must be understood and transmitted together within the same organisational frame. Learning in vocational schools is often carried out in several different places and organisations either in a classroom, practicum room, field or workplace. Changing understanding from one place to another is a complex task to be fully understood by learners (Taylor & Freeman, 2014).

4.2. Knowledge of OSEH

The results showed that more than 79% of the students' scores in occupational safety and health exam were below the minimum completion criteria, thereby indicating that only 21% of the students had a sufficient understanding. Based upon this result, if the test were a requirement for competency graduation, then only 21% of them successfully could pass. This finding was similar to that of Andersson et al.'s (2014) study, which found that students had limited knowledge of risk analysis and prevention. Anderson et al. (Andersson et al., 2014) reported that the students considered occupational safety and health to be their responsibility, while in reality it is supposed to be the responsibility of all parties or stakeholders related to their work. They also mentioned that the provision of material on workplace safety was given in the first year of vocational education in Sweden.

To date, there has been no data on work accidents with vocational school graduates as the victims (Schulte et al., 2005). Nonetheless, integrating occupational safety and health into vocational school lessons is extremely important for the prevention of any possible risks of injury and work-related diseases in students' future workplaces both physically and mentally. This is particularly crucial for vocational school alumni to the extent that their education is career-oriented. Accordingly, efforts to evaluate the implementation of occupational safety and health in vocational education and other labour preparation programmes require an in-depth study and systematic evaluation (Schulte et al., 2005).

Furthermore, Chen (2010) also argued that students' orientation in their schools tends to focus merely upon the development of their expertise, which results in a limited knowledge of other more general subjects including occupational health and safety. In other words, students seem to have failed to realise the importance of their well-being in their future workplaces. Anderson et al. (2015) also mentioned that occupation safety and health has been generally overlooked during students' internship programmes, thus further showing the need for more awareness of all stakeholders regarding students' welfare in their work.

Schulte et al. (2005) recommended that school curricula should cover six main areas of study: understanding work risks, finding the risk sources, working in a safe condition, responding to disasters

efficiently, knowing their rights either as learners or as workers in the future and taking immediate action. All of these materials should be given to students before they carry out industrial work practices. This is to avoid the occurrence of work accidents for students while they are in the industry as interns.

4.3. Students' attitude on the implementation of occupational safety and environmental health

Based on the results of the study, it appears that the students' attitudes towards the implementation of OSEH are dominantly in the 'good' category. For the category of 'excellent', the highest indicators were for the work environment and the implementation of SOP. This shows that the work environment and SOP managed by the school were particularly good. Unfortunately, 20% of the students mentioned that their schools had limited PPE.

The problem of the implementation of occupational safety and health in vocational schools is generally caused by the limitations of equipment, facilities, infrastructures in mechanical engineering workshops and poor management systems. Therefore, Styawan et al. (2019) suggested that vocational high schools should improve occupational safety and health management systems, offer training programmes for teachers and vocational education personnel and provide awards and sanctions for all school residents.

Education and training are some of the most effective ways of influencing people's attitudes and practical ability to optimise workplace safety (Gherardi & Nicolini, 2002). However, some claim that education may not be effective to promote the importance of occupational safety. One of the reasons is the assumption that theories of occupational safety are still difficult to be implemented into safe practices due to differences in the conditions between the two (Pisaniello et al., 2013; Somerville, 2007).

Petersen et al. (2008) developed an innovative assessment method to promote safety-conscious attitudes towards students in undergraduate civil engineering courses to increase knowledge about risk management and occupational health and safety. Arpat and Yeşil (2017) mentioned that the understanding, attitude and implementation of internalised occupational safety and health in learners will offer a huge advantage for themselves especially when they are in the world of work.

Students' attitudes towards the implementation of OSEH in the school environment can also be seen from the difference between male and female attitudes. Chatigny et al. (2012) explained that female workers appear to pay more attention to occupational safety and health in the workplace, but sometimes they also disobey the rules while working with their male counterparts. It shows that gender roles in the implementation of OSEH could also contribute significantly.

Students' attitudes towards the implementation of OSEH must be continuously improved. This is important since they will need to implement this competence in their future workplace. Grytnes et al. (2018) stated that both the school and the industry or company share the responsibility for the health and safety of students during the implementation of industrial practices. Therefore, the school should be responsible for the enhancement of students' understanding and positive attitudes towards OSEH before their industrial practices.

4.4. The relationship between students' knowledge and attitudes to the implementation of OSEH

The results showed that there was no relationship between students' knowledge and attitudes towards the implementation of OSEH. This is similar to the research by Sarkawi (2015), who also found no correlation between students' knowledge and attitude for both male and female students. On the contrary, Wulandari et al. (2021) reported that students' attitudes towards their environment have a positive relationship with their knowledge of environmental literacy, and even the former could significantly influence the latter. Similarly, Arcury (1990) also in his research found that students'

environmental knowledge was positively correlated with their attitudes, although the relationship was weak. The correlation between knowledge and attitude and the limited knowledge of the environment could have implications on policymaking that can create problems for the surrounding environment.

The relationship between knowledge and attitudes can even be negative for several factors. Evanjeli (2021) revealed that the relationship between knowledge and attitudes towards inclusion has a positive correlation but it tends to be weak. The author further mentioned that knowledge of disabilities is not a factor that encourages students' attitudes towards inclusiveness. She also stated that the experience of interacting with individuals with special needs does not significantly contribute to knowledge and attitude towards inclusiveness. On the other hand, Ahmad and Manan (2020) reported a medium relationship between students' knowledge and attitudes in terms of health practices during the COVID-19 pandemic. This suggests that the relationship between students' knowledge and attitude may or may not be correlated, thus indicating the need for further investigation.

4.5. Differences in Students' Occupational Safety and Environmental Health Knowledge by Gender

Table 8 shows the differences in knowledge of male and female students by referring to the equal variances assumed. The column of Levene's Test for Equality of Variances shows a significance value of 0.230, which is greater than the value of 0.05. This explains that the data variance of the male and the female groups is not different or homogeneous. The column of the t-test for Equality of Means shows that the value of significance (two-party test) is 0.534, which is greater than the value of 0.05. This indicates that there is no difference between the knowledge of male and female students.

This condition is reinforced by data showing that the average difference in values between the two variables is very small at only 0.22990. The t-count value is -0.623, while the two-party test t-table value (288, 0.05) is 1,968. T-counting grades < t-table grades further show that there is no difference between OSEH knowledge of male students and female students.

The results showed that there was no difference between male and female students' knowledge of OSEH. The absence of this distinction is for students with both high knowledge and low knowledge. A similar result was also discovered by Sarkawi (2015), who reported that they found no difference between male and female students' knowledge of occupational safety and health for those with considerable knowledge. Interestingly, however, the difference was revealed only for those with limited knowledge.

4.6. Differences in students' attitudes to the implementation of OSEH by gender

Table 10 shows the differences in attitudes of male and female students by referring to the equal variances assumed. The column of Levene's Test for Equality of Variances section shows a significance value of 0.867, which is greater than 0.05. This explains that the variance of data from the male and female groups is not different or homogeneous. The column of the section t-test for Equality of Means shows that the value of significance (two-party test) is 0.364 and greater than the value of 0.05. This indicates that there is no difference between the knowledge of male and female students.

This condition is reinforced by data showing that the average difference in values between the two variables is very small at only 1.14113. The t-count value is -0.910, while the two-party test t-table value (288;0.05) is 1,968. T-counting < t-table grades further shows that there is no difference between OSEH knowledge of male students and female students.

The result indicates that there was no difference between the attitude of male and female students towards the implementation of OSEH. This study showed that both females and males were less concerned about hygiene-related issues and relied more on the caretaker of the boarding house. They

argued that they had paid cleaning fees and were not used to cleaning their rooms. Nevertheless, the business of cleaning the house was still categorised as a feminine affair.

5. Conclusion

The implementation of OSEH was effectively implemented in the group of expertise programme subjects (C2) and the group of expertise competency subjects (C3). Based on the minimum completion criteria of 70, it can be concluded that only 20% of the students had adequate knowledge of OSEH. The students' attitudes on the implementation of OSEH are mostly in the 'good' category. However, the current study also revealed the lack of the availability of PPE, thus needing attention.

Moreover, this study showed that there was no relationship between students' knowledge and attitudes in the implementation of OSEH. This study also indicated that there was no difference between male and female students' knowledge in OSEH, both of which had limited knowledge. Finally, this study found that there was no difference between male and female students' attitudes to the implementation of OSEH. The attitudes of both groups were reported to be positive.

6. Recommendations

Based on the research conclusion, there are some suggestions for stakeholders. Firstly, OSEH as a competence needs to be explored more within vocational high schools for the prevention of any possible risks of injury and work-related diseases in the workplace. Although the implementation of this competence was well conducted within the schools under study, students' understanding of the subject was still found to be limited, thereby showing the need to improve students' knowledge. Finally, since PPE was found to be limited, schools need to provide more facilities to improve students' practical activities.

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