Original Research Article

Performance of The Occupational Health, Safety, and Environment (HSE) Culture in Educational Laboratories

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ABSTRACT

The Department of Marine Science and Technology (MST) has a physics laboratory (dry and wet) and a field laboratory. Laboratory activities cannot be separated from potential hazards that can cause the risk of work accidents due to tools, materials, and the work environment. The establishment of a culture of health, safety, and the environment (HSE) and the application of a procedure for identifying possible risks and hazards, known as job safety analysis (JSA), are two strategies used to prevent and lessen work accidents in physics and field laboratories. Determining the efficacy of introducing HSE culture in the lab was the aim of this investigation. Analytical and observational cross-sectional methods were employed in quantitative research procedures. The variables used to evaluate whether the HSE culture has been applied are knowledge of HSE, the application of HSE, and comprehension of PPE. The results of observations showed that the application of HSE was reasonably efficient as a guide for safe and healthy activities; nevertheless, it still requires assistance and the fulfillment of many work processes in the laboratory.

Keywords: Laboratory, hazards, risks

INTRODUCTION

The environment, the people who do tasks in the laboratory, and practicum instruments and materials can all contribute to the potential dangers of work accidents in tertiary institutions laboratories. If work is not in accordance with procedures and complying with Laboratory Health, Safety and Environment (HSE) it is one of the potential opportunities for accidents to occur in the laboratory. To minimize the risk of work accidents, knowledge regarding the application of HSE in the Laboratory is required by implementing an HSE culture for everyone who works in the laboratory, one way is to apply the Hazard Identification and Potential Risk (HIPR) or Job Safety Analysis (JSA) procedure.

The implementation of HSE on campus is critical to ensuring that all lecturers, technicians, assistants, students, and other users can work securely and in accordance with the intended goals. Another essential aspect of HSE implementation is determining its feasibility so that it is recognized by accreditation bodies both nationally and internationally. The implementation of HSE in the MST Department relates to IMarEST international accreditation and how to implement HSE in all learning activities, both on and off campus.

According to Cahyaningrum et al. in 2019,[1] HSE knowledge necessitates the assistance of experienced HSE experts or supervisors in order to decrease unsafe actions.[1] According to Permenaker Number 05 in 2018[2] and Abidin and Ramadhan in 2019[3], variables that can cause work-related accidents and illnesses include physical hazards, chemical hazards, biological hazards, ergonomic hazards, and psychological hazards.[2,3]

Other studies found that there are several factors that can reduce work accidents, including adopting job safety analysis (JSA) to improve the Occupational Health and Safety Management System.[4] Workers are more attentive and disciplined as a result of this. Furthermore, JSA is used as a tool to apply HSE in the laboratory. As revealed by Daryaningrum, JSA (Job Safety Analysis) is one of the techniques or ways to identify risks before risk occurs in ongoing activities.[4,5]

Muscle cramps, being struck by heavy equipment, falling, spraining, slipping, and becoming stuck in a machine are all risks of work accidents in the workshop or laboratory.[6] Electric shock, hitting a machine, cutting, being struck, being exposed to a hot surface, being exposed to fire, smoke inhalation, tripping over a cable, being struck by a grinder, being exposed to sparks, being struck by a pipe,

being struck by a drill bit, being crushed, being struck by steel wool, being struck by a nail, tripping over a plate, being struck by a knife, and being scratched are other risks that may occur.[6,8]

Based on the importance of adopting OSH, the overall goal of this study is to determine the effectiveness of implementing HSE culture in MST Department laboratories based on the behavior of laboratory workers, which includes educational staff and students.

METHOD

From May to September 2022, this study was carried out in the physical laboratory of the Department of MST-IPB and in the outdoor laboratory. Because the observations were made at a specific time or during a specific period, the research was observational quantitative research using an analytic survey with a cross-sectional method. The purpose of this study was to establish the relationship between several variables related to HSE knowledge and behavior, as well as HSE culture in the MST Department. It is then determined how much impact the independent variables have on the dependent variable based on these variables.

Questionnaires were used to gather primary data from research participants. According to According to Sugiyono in 2008,9 a questionnaire is a method of gathering data in which participants are provided with a series of written statements or questions to complete. The questionnaire was developed based on research needs related to the knowledge and HSE applications that have been used. Respondents in this study included final semester students conducting research in the MST Department laboratory during the even semesters of the 2020-2021 academic year and the odd semesters of the 2021-2022 academic year, as well as educational staff who work in or are related to laboratory activities, for a total of 58 respondents.

The sample size of 57.54 as a respondent is calculated based on the finite population formula,[9] the community can be determined by at least 57 people. The MST department has a total population of 68 people, including 21 education staff and 47 students' research and practice students. 58 respondents can be used as population data to determine the efficacy of HSE culture in the MST department, assuming the minimum sample amount. Questionnaires are data gathering techniques that involve asking respondents to reply to a series of questions or written statements (n = 6). The purpose of this study is to ascertain how the MST Department's students and faculty members feel about the use of HSE in laboratory instruction. Information about the HSE program's implementation on campus will be gathered during the evaluation, and this information will be utilized to choose the best course of action.[10] Student respondents are students who perform research in campus laboratories as well as research activities or practicums off campus.

The quantity of samples is calculated using the finite population formula.[9] In this research, sampling was done using proportional random sampling. Based on the responses to all of the questionnaire items, the general assessment variable is HSE culture.

Data analysis with univariate and bivariate methods. Univariate analysis is used to describe the frequency distribution of each study variable in proportions and percentages. Knowledge of HSE, the application of HSE, and PPE understanding are variables used to assess the application of HSE culture.. Bivariate analysis, on the other hand, is a two-variable processing technique in which there are independent variables (knowledge, application of HSE, and comprehension of using PPE) and a dependent variable. (HSE culture). This technique is used to determine whether there is a link between HSE knowledge and behavior and HSE culture within the MST Department. The statistical test employs Spearman's rank correlation to acquire data interpretation from the relationship between the independent variables and the dependent variable, which serves as the foundation for decision making.

a. If sig 0.05, it can be inferred that there is a significant correlation between the variables connected.
b. If sig > 0.05, it is stated that there is no significant correlation between the variables connected.

Furthermore, to ascertain the closeness of the relationship between the two variables under consideration (r), use the following criteria[11]:

0 - 0.20 = Very Weak
0.21 - 0.40 = Weak
0.41 - 0.70 = Close enough
0.71 - 0.90 = Close
0.91 - 1 = Highly Close

RESULT AND DISCUSSION

Data collection in the shape of a questionnaire was carried out in both on and off-campus laboratories. Respondents who were doing fieldwork were students who were doing activities at Gopek Beach, Serang, Banten, and Parigi, Pangandaran. The education staff respondents were in the

classroom and on campus when they completed the questionnaire. The ability to explain the definitions and requirements of HSE is a respondent's assessment of the understanding of HSE knowledge. According to Yana's 2019[12] statement, HSE knowledge is the capacity to discover and acquire information about occupational health and safety derived from visual and auditory assessments.

Respondents in this study included 11 laboratory and administrative education employees and 47 final-year students conducting research activities both on and off campus. The MST Department has 21 educational staff members, including 9 technicians and 12 managers. Table 1 shows the characteristics of the respondents in this research. The answers from Table 1 are meant to address a number of concerns about how HSE is implemented in the lab by following SOPs during operations, marking hazardous materials, comprehending MSDS, being aware of PPE and first aid, etc.

According to Table 1, the female respondents outnumbered the male respondents by 39 people, including 5 education staff and 34 female students, while the male respondents included 19 people, including 6 education staff and 13 students. HSE socialization has taken the shape of a safety induction at the start of lectures as well as activities conducted off campus. Since 2021, grade 2 students have been required to take compulsory HSE classes in odd semesters, while final year students will receive a safety induction and will be required to prepare JSA for all off-campus activities. At least once a year, education staff has also engaged in HSE socialization in the form of safety induction when participating in activities on and off campus.

The questionnaire-based HSE culture analysis parameters include information, application, and comprehension of the importance of PPE.

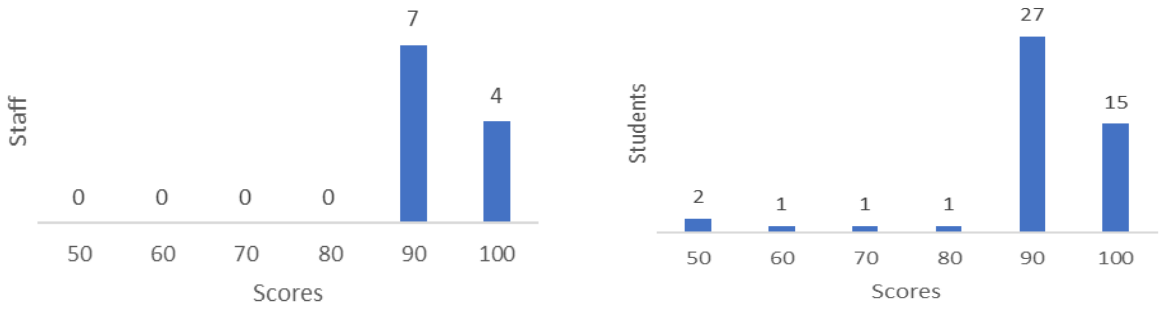
On campus, Occupational Health, Safety, and Environment (HSE) is a service that protects the entire academic community, educational staff, and stakeholders while they conduct out their activities. The use of HSE is regarded as an attempt to prevent workplace accidents and disease caused by work. The HSE implementation is a long-term investment to meet IMarEST's (Institute of Marine Engineering, Science, and Technology) international accreditation requirements and to enhance the MST Department's performance and competitiveness in the future. Understanding of HSE information is assessed through questions about hazard identification, analysis, and control, which are listed in the Hazard Identification and Potential Risk (HIPR) or Job Safety Analysis (JSA) forms.

Table 1. The Distribution of Interviewees Characteristics in The MST Department

Characteristic	Frequency (n)	Percentage
Gender		
Male	19	33%
Female	39	67%
Total	58	
Activities		
Campus	4	7%
Field	54	93%
Total	58	
Socialization HSE		
Ever	58	100%
Never	0	0%
Total	58	

According to the survey's findings (Figure 1), the 11 members of the educational staff who participated in the survey had a comprehension of the questions pertaining to the definition of HSE, SOPs, and symbols that were available on campus. Due to the description, up to four persons have a score of 100 for understanding every question, and up to seven people can properly answer 90 of the questions. Regarding HSE students' knowledge, 47 respondents said

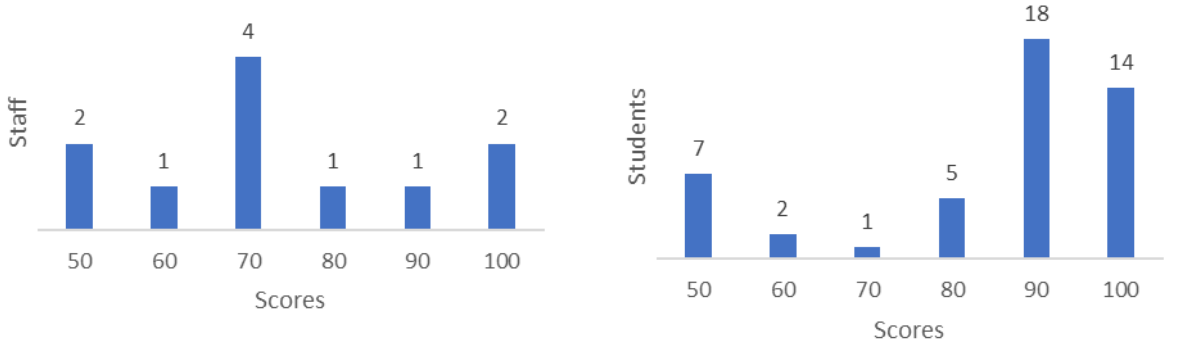
they understood more because lecturers and technicians always gave a safety induction on how to use tools, materials, and laboratories. Given a description, 15 people could answer all the questions correctly with a score of 100, 26 people could answer 90, 2 could answer 80, and each person could answer 70 and 50. Given that over 41 individuals were able to correctly answer the question with a score of 90, it can be concluded that there is a good comprehension and awareness of the significance of HSE during the teaching and learning process in the laboratory.



(a) (b)

Figure 1. The Scores of HSE Knowladge Held by (A) Staff (Educators) and (B) MST Department Students

In order to conduct activities in a laboratory that serves as the foundation for assessing the respondents' HSE program, the HIPR and JSA forms were previously completed. According to the results of the survey, over 70% of teachers and students have implemented practices that align with those established by the Lab and Study Program. (Figure 2). This was achieved, consciously or unconsciously, by showing zero accident incidents at work. To facilitate the implementation of HSE, the MST department has created a curriculum that includes induction of safety. It is always offered during laboratory practicum or college. Over 70% of students and teachers have followed the procedures as established by the Study Program and Laboratory, according to the questionnaire's results. Figure 2 shows that only three respondents charged a score of 50–60, while eight respondents answered with a score of greater than 70. Displaying zero accidents at work is one way to achieve this, whether on purpose or accidentally. In order to facilitate the implementation of HSE, the MST department has created a curriculum that includes safety induction. It is always offered during lab practicums or lectures.



(a) (b)

Figure 2. The Scores of Staff (A) and Students (B) in The MST Department Who Have Implemented HSE.

Lecturers and technicians give safety inductions early in college before students use tools and materials in the lab. In order for students to understand how to prevent accidents during their laboratory practicum, the lecturer will go over the significance of the following method. Complete HSE and PPE equipment that is customized for the type of laboratory is required for prevention. In order to prevent work mishaps brought on by the usage

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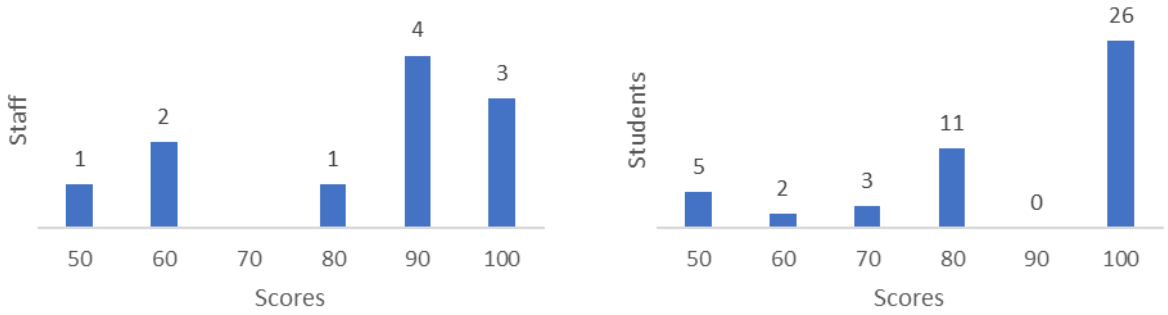
of instruments, laboratory equipment maintenance procedures are also crucial.

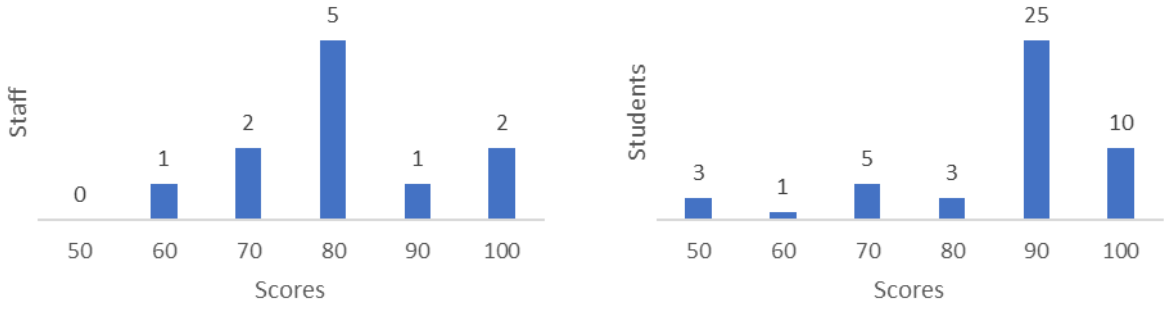
One tool that can protect a person in the workplace is personal protective equipment (PPE), which isolates a person's entire body from potential threats.[13] In order to prevent work accidents, occupational health is essential, as stated in ILO recommendations.[134] The work environment, which encompasses chemical, physical, biological, ergonomic, and psychological elements, is the usual source of potential health risks in the workplace.[14] In addition to helping students, technicians, lecturers, and other laboratory workers avoid work-related mishaps, the guidelines developed and put into practice in all laboratories also help them get used to their jobs and the use of tools, equipment, and supplies in the lab.



(a) (b)

Figure 3. The Scores of Staff (a) and MST Department Students (B) Who Comprehend PPE.

The questionnaire can assess knowledge, OHS implementation, and awareness of the importance of wearing personal protective equipment, all of which are indicators of how successfully OHS culture is being applied in the MST Department's laboratory setting. According to the questionnaire, 38 students (81%) and eight members of the educational staff (73%) had a positive OHS culture. This indicates that more respondents were judged competent of putting OHS culture into practice when performing laboratory activities and were able to accurately answer with a minimum score of 70. (Figure 4).



(a) (b)

Figure 4. The Scores of Staff (a) and MST Department Students (b) Who are Conscious of The Importance of HSE

The characteristics of the variables studied, both dependent and independent variables, are described in univariate analysis to gain an overview of the degree of knowledge, application of HSE, and understanding of the use of PPE described in Table 2.

Table 2. Univariate Analysis of PPE Knowledge, Application, and Comprehension

Variable Research	Frequency(n)	Percentage
HSE Knowledge		
Good	54	93%
Moderate	1	2%
Less	3	5%

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Variable Research	Frequency(n)	Percentage
HSE Implementation		
Good	41	71%
Moderate	5	9%
Less	12	21%
Used of PPE		
Good	46	79%
Moderate	7	12%
Less	5	9%
HSE Culture		
Good	46	79%
Moderate	7	12%
Less	5	9%
Total Sub variables	58	100%

According to Table 2, a total of 58 respondents stated that, on average, 54 (93%) had good HSE knowledge, while 4 (7%) had less HSE knowledge. 71% of the 41 respondents had excellent variable measurement of HSE implementation, while only 29% had poor HSE implementation. Similarly, when it comes to PPE use, the average respondent understands the importance of PPE, as do 45 other people (78%), and those who do not comprehend the benefits of using PPE are 13 respondents (22%). Based on the ability to comprehend and apply HSE, it is clear that 46 respondents (79%) have an HSE culture, while 12 people (21%) do not.

Based on the results of the statistical test using the Spearman rank test between HSE knowledge and HSE culture (Table 3), it got a p-value of 0.667 (> 0.05), indicating that there is no significant relationship between HSE knowledge and HSE culture. However, the relationship between the two variables studied (r = 0.5) is quite nearby.

The same findings hold true for the statistical tests of HSE execution and HSE culture. (Table 4). There is no significant relationship, but there is one that is relatively close. In contrast to the previous variables, the statistical test results using the Spearman rank test between the use of PPE and HSE culture obtained a p-value of 0.000 (<0.05), so Ho was rejected, and it can be concluded that there is a significant relationship between the use of PPE and K3L culture, and the relationship between the use of PPE and HSE culture is very close. (Table 5).

Table 3. The Link between HSE Knowledge and HSE Culture in Laboratory Activities for Educators and MST Students

Knowledge HSE	HSE Culture				Total		P-value	(r)
	Good		Moderate					
	N	%	N	%	N	%		
Good	54	93	46	79	100	86		
Moderate	1	2	7	12	8	7	0.667	0.5
Less	3	5	5	9	8	7		

Table 4. Represents The Connection Between HSE Implementation and HSE Culture in Laboratory Activities for Educational Personnel and MST Department Students

Implementation HSE	Culture HSE				Total		P-value	(*r*)
	Good		Moderate					
	N	%	N	%	N	%		
Good	41	71%	46	79%	87	75%		
Enough	5	9%	7	12%	12	10%	0,667	0,5
Less	12	21%	5	9%	17	15%		

Table 5. The Association Between The use of Personal Protective Equipment (PPE) and HSE Culture in Laboratory Operations for Education Professionals and MST Department Students

Used of PPE	Culture HSE				Total		Pvalue	(r)
	Good		Moderate					
	N	%	N	%	N	%		
Good	46	79%	46	79%	92	79%		
Moderate	7	12%	7	12%	14	12%	0	1
Less	5	9%	5	9%	10	9%		

Risks occur in research activities and laboratory practices due to a variety of factors, including the environment, instruments, materials, and usage. Implementing safe practices does not necessarily remove the possibility of harm, as it is linked to a variety of risk variables. However, with procedural standards, expert supervision, and the identification of hazards and potential risks, the probability of an accident can be reduced. For education staff, notably laboratory technicians and MST Department students, the application of safety, occupational health, and environment (HSE) is critical in laboratory learning. With a rate of 79%, respondents from educational personnel and students understand and are aware of the necessity of HSE in laboratory learning.

According to the respondents' understanding (79%), the usage of PPE in the MST Department's laboratory has a strong connection to the implementation of HSE. Furthermore, 93% of those surveyed in this study were knowledgeable of HSE.

According to Ramadan and Ismara (2014), students benefit greatly from the implementation of HSE since it is necessary to gather JSA forms prior to practicum and do research as a means of monitoring risky actions.[16] The laboratory facilities are outfitted with appropriate PPE so that students can conduct tasks safely. Students can study more successfully and efficiently in a nice and standard work or laboratory setting. A positive work or practicum environment encourages students to improve their laboratory learning outcomes.

CONCLUSION

According to the results of the survey in this study, the efficacy of implementing HSE culture in the MST Department's laboratory is fairly good, but it still requires support and the completion of numerous work processes in the laboratory as a guide for safe and healthy activities. This research can be used as a reference in an internal HSE culture assessment prior to carrying out external supervision to achieve the IMarEST accreditation requirements for HSE implementation.

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