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Research paper

Analysis of Workshop Layout on the Implementation of Occupational Health and Safety (K3) in Woodworking Workshop of the Department of Civil Engineering and Planning Education, UNY

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ABSTRACT

Background: The implementation of a workshop layout that is not following the 2010 ILO & IEA regulations can cause work accidents, hence the need for OHS implementation in woodworking workshops. The objectives of this research are: (1) to determine the suitability of the layout of the Woodworking Workshop of DPTSP UNY with the 2010 ILO & IEA regulations. (2) To determine the suitability of the K3 implementation of the woodworking workshop of DPTSP UNY with SNI 45001 2018.
Methods: The research method used in this study is descriptive static with a percentage scale. This research was conducted at the Woodworking Workshop of DPTSP UNY with the research sample being lecturers, technicians, and students who were using the workshop. Data was collected using a questionnaire with a Guttman scale.
Results: The study yielded the following data: (1) There is conformity between the layout of the Woodworking Workshop and the ILO & IEA regulations with an average of 78%. (2) There is conformity of K3 in the woodworking workshop with SNI 45001 with an average of 90%.
Conclusion: The suitability of the layout of the woodworking workshop can facilitate the movement of woodwork with the availability of tools that are quite complete, and the layout of the equipment makes it easy for students to find tools, besides that the storage and maintenance of tools is very well maintained. The suitability of K3 in the woodworking workshop provides a high guarantee of safety if it is supported by the discipline of using the correct work procedures and adherence to procedures. In addition, the room with K3 standard criteria to create a safe, comfortable, and healthy environment in carrying out practical activities.

INTRODUCTION

A workshop is a facility that supports the practical learning process following theoretical learning in vocational education. The woodworking workshop is one type of workshop in the vocational education program used for carrying out practical woodworking lessons (Saputro & Hidayah, 2021). A workshop or laboratory is a basic thing needed in an educational environment (Xu et al., 2023). A workshop provides flexibility according to the minimum required room size while considering function, ground contour, ergonomics, and Occupational Health and Safety (K3) (Darmono et al., 2021). Layout planning is a method to design a workshop with various equipment and machines in the woodworking workshop, supporting the smooth running of practical and production processes (Ghufron et al., 2019). The implementation of a safe and healthy work area for students related to temperature, lighting, ventilation, and noise is an effort to minimize work accidents (Osuntuyi, 2020).

The Department of Civil Engineering and Planning Education (DPTSP) is one of the departments in the Faculty of Engineering at Universitas Negeri Yogyakarta (UNY). Skills are a prerequisite that DPTSP students must possess, including woodworking and furniture practice. The woodworking practice course is divided into Woodworking Practice I, Woodworking Practice II, and Furniture courses. These courses include theoretical lectures explaining the procedures for working on a wooden product and practical lessons that hone students' skills.

Planning the layout of the woodworking workshop aims to optimize the utilization of workshop land (Yang, C., Liu & Xu, 2022). Lack of mobilization in the layout of the woodworking workshop is a problem that results in decreased workshop performance. Therefore, workshop layout planning is needed (Zhou et al., 2023). The layout of the woodworking workshop is influenced by several factors, namely layout mobilization, access flexibility, effective area use, safety, and occupational health (Besbes et al., 2017). Paying attention to the factors that influence the layout and management of the workshop, will be able to improve the performance of the woodworking workshop. In addition, the handling of information in woodworking workshops can be improved by the information system (Yang, 2020).

Specifically, the DPTSP woodworking workshop has several aspects of conditions. These aspects include the work area, workshop environment, temperature, lighting, workplace, workshop floor, and woodworking equipment. The work area of the DPTSP woodworking workshop has a practical room size of 336 m^2, while the theory room size is 24 m^2. The practical room is divided into two areas: the machine work area and the hand tool work area. The hand tool work area is equipped with 10 workbenches, each measuring 2 x 1 m, with power outlets, and can be used by a maximum of 4 students.

The DPTSP woodworking workshop environment appears clean but less tidy due to the storage of students' practice results on the sides of the practical area. The noise level in the workshop environment during machine practice is 94 dB, and during non-machine practice, it is 83 dB. The noise level during machine use does not meet the noise threshold standard of 70-85 dB.

The temperature in the DPTSP woodworking workshop at 11:00 AM in sunny conditions is 89.6°F, which does not meet the standard practice room temperature of 80°F. Natural and artificial lighting is necessary for students to see objects clearly (Bonaventura et al., 2020).

Lighting must meet the requirements of not being too bright or too dark. Additionally, optimizing natural lighting is needed, but additional lighting is required under certain conditions (Hargiyato, 2017). The lighting level in the DPTSP woodworking workshop is 291 lux, which does not meet the standard in SNI 6197 of 2020. The average lighting level in the industry for fine work is 500 lux (National Standardization Agency, 2020).

The workplace is comfortable but lacks an emergency door for exiting during emergencies. The floor is clean and non-slip, and the equipment and tools are easily accessible. The workshop floor is flat, non-slip, smooth, undamaged, and marked with floor markings in the machine work area but lacks color demarcation on the passageways. The woodworking workshop has several main tools, both machine and manual tools, arranged to ensure users' comfort and safety during practice.

Everyone in vocational education involved in using the workshop must participate in maintaining and implementing K3 (Hidayat & Wahyuni, 2016). K3 is not only necessary for businesses but also for all fields, including education (Erfian & Raharjo, 2020). K3 is a regulation that ensures workers' health and safety while working (Darmayani et al., 2023). In engineering, occupational health and safety are intertwined as they comprise two disciplines (Neto & Amaral, 2024). Workshop management is one of the things that are applied to organize the space, time, and essence of practice for students so that the implementation of practice can be stable (Mohamed & Kimaro, 2019). The implementation of occupational health and safety management has a role related to the progress of motivational progress from the perspective of workshop users so that health and safety in the workshop can be created (Bergman et al., 2023). Knowledge of occupational health and safety is essential given the mandatory application of OHS repeatedly when practicing in the woodworking workshop.

Based on observations and interviews with DPTSP woodworking workshop technicians, it was found that work accidents rarely occur when the workshop is used during class hours and supervised by technicians or lecturers. Conversely, accidents often occur when practice is conducted outside class hours without technician or lecturer supervision, It shows the importance of student knowledge and awareness related to health and safety in the workshop. In addition, efforts are needed to improve the application of personal protective equipment for students (Wingate et al., 2023).

The conformity of the woodworking workshop room with regulations plays an important role in the students' practical learning process. The woodworking practice process will run smoothly and efficiently if the tools are systematically arranged with adequate spacing and area according to standards and considering K3. Layout planning is related to K3, where a well-designed layout adhering to standards can reduce the risk of work accidents and increase students' productivity.

METHODS

The research method used is descriptive. Descriptive research involves using observation, interviews, or questionnaires to describe the state or value of a variable independently (Sugiyono, 2019). Descriptive analysis is used to provide an overview of the workshop layout and the implementation of Occupational Health and Safety (K3) in the DPTSP UNY woodworking workshop.

This research was conducted at the DPTSP woodworking workshop in Kampung Karang Malang UNY, with the population consisting of students, technicians, and lecturers of DPTSP UNY. The sample used in this research included students, technicians, and lecturers currently using the DPTSP UNY woodworking workshop. A total of 35 individuals were sampled.

The research instrument in this study is a questionnaire concerning the workshop layout and K3 variables in the DPTSP woodworking workshop. The workshop layout variable has 5 indicators: workplace design, material storage & handling, equipment layout, lighting, and supporting facilities. Meanwhile, the Health and Safety (K3) variable has 7 indicators: health and safety policy, leadership and commitment, health and safety management, hazard identification, safety control, and awareness of health and safety.

The measurement scale used in the instrument is the Guttman scale. The Guttman scale is a measurement scale that only uses 2 intervals for answer alternatives (Sugiyono, 2019). The answer alternatives on the Guttman scale consist of two options: "yes-no," thus obtaining clear answers to the issues. Table 1 shows the scores for the Guttman scale answer alternatives.

Table 1.
Scores for Guttman Scale Answer Alternatives

No.	Answer Alternative	Statement Score
1	Yes	1
2	No	0

After data is collected, data analysis can be performed. Data analysis techniques are steps used to process data so conclusions can be drawn (Sugiyono, 2019). The data analysis technique used in this research is descriptive statistics. This data analysis also uses a percentage scale in its results, which are then interpreted based on the obtained data. The percentage calculation procedure is as follows, with the assessment criteria shown in Table 2.

$$\text{Percentage of each indicator} = \frac{\text{Number of (Yes) answers}}{\text{Total nunber of answers}} \text{ x } 100\% \quad (1)$$

$$\text{Percentage of variable} = \frac{\text{Sum of average of each indicator}}{\text{Number of indicators}} \text{ x } 100\% \quad (2)$$

Table 2.
Assessment Criteria

Percentage	Assessment
0% - 50%	Not good
51% - 100%	Good

RESULTS AND DISCUSSION

The research data was obtained from students, lecturers, and technicians practicing in the DPTSP woodworking workshop. The study was conducted by 35 respondents consisting of students, lecturers, and technicians. The analysis was conducted to determine the conformity of the woodworking workshop layout with the ILO & IEA 2010 regulations and to determine the conformity of Occupational Health and Safety (K3) with SNI 45001 of 2018.

A. Workshop Layout Variable

1. Workplace Design Indicator

The workshop layout variable has 5 indicators: workplace design, material storage & handling, equipment layout, lighting, and supporting facilities. Meanwhile, the Health and Safety (K3) variable has 7 indicators: health and safety policy, leadership and commitment, health and safety management, hazard identification, safety control, and awareness of health and safety. The tabulation results of the workplace design indicator can be seen in Table 3.

Table 3.
Tabulation of Workplace Design Indicator

No	Items	Y	N	(%)
1	The workshop area is wing-shaped	33	2	94%
2	The machine work area is > 8 m^2	31	3	89%
3	The condition of the floor in the woodworking workshop is flat and not wavy	26	9	74%
4	There are color demarcations on the workshop floor	21	14	60%
5	The main door of the woodworking workshop is a rolling door	18	17	51%
6	The main door width > 4 m and height is > 5 m	19	16	54%
7	There is an easily accessible emergency door in the woodworking workshop	31	4	89%
8	There is a device to control the temperature in the woodworking workshop	8	27	23%
9	The temperature in the workshop is between 20-25 ºC	16	19	46%
10	The equipment arrangement in the woodworking workshop follows the equipment operation flow	29	6	83%
	Total Average			**66%**

2. Material Storage and Handling Indicator

The implementation of the layout in the woodworking workshop can be seen through the material storage and handling indicator. This indicator consists of 2 sub-indicators: passageways and waste management. The tabulation results of the material storage and handling indicator can be seen in Table 4.

Table 4.
Tabulation of Material Storage and Handling Indicator

No	Items	Y	N	(%)
1	Passageways have a minimum width of 125-140 cm	30	5	86%
2	Passageways can be used for two-way traffic	28	7	80%
3	There is a container for collecting wood shavings from woodworking	31	4	89%
4	Wood scraps from practice are stored in a special container	30	5	86%
5	There is a vacuum cleaner for small cleaning particles	19	16	54%
	Total Average			**79%**

3. Equipment Layout Indicator

The implementation of the woodworking workshop layout can be seen through the equipment layout indicator. This indicator has 3 sub-indicators: equipment availability, equipment layout, and equipment storage & maintenance. The tabulation results of the equipment layout indicator can be seen in the following Table 5.

Table 5.
Tabulation of Equipment Layout Indicator

No	Items	Y	N	(%)
1	There is an inventory data of the types and quantities of tools	27	8	77%
2	Ease access to necessary equipment	34	1	97%
3	The amount of equipment in the woodworking workshop is sufficient for use by one class	30	5	86%
4	Frequently used tools are stored closer to the workplace	31	4	89%
5	The location of the equipment in the woodworking workshop does not interfere with the work process	30	5	86%
6	The equipment is neatly arranged so that it is easy to find	35	0	100%
7	There is a cupboard for hand tool storage	34	1	97%
8	There is a workshop equipment inspection schedule	21	14	60%
	Total Average			**86%**

4. Lighting Indicator

The implementation of the woodworking workshop layout can be seen through the lighting indicator. This indicator consists of 5 sub-indicators: light optimization, color usage, illumination, glare prevention, and workshop lighting maintenance. The tabulation results of the lighting indicator can be seen in Table 6.

Table 6.
Tabulation of Lighting Indicator

No	Items	Y	N	(%)
1	The spread of sunlight in the woodworking workshop is optimal	32	3	91%
2	Large window size and placed in a higher position	29	6	83%
3	Use of bright color paint on the workshop walls	22	13	63%
4	There is additional lighting in the workshop, corridor, and storage room	28	7	80%
5	Painting on the walls of the workshop does not use glossy colors	29	6	83%
6	Placement of lights in the center of the workshop and not close to the window	32	3	91%
7	Regular cleaning of windows and light holes in the woodworking workshop	17	18	49%
	Total Average			**77%**

5. Supporting Facilities Indicator

The implementation of the woodworking workshop layout can be observed through the supporting facilities indicator. This indicator consists of 3 sub-indicators: changing area, washing area, and sanitation facilities, theory room, and marking of hazardous areas. The tabulation results of the supporting facilities indicator can be seen in Table 7. The first sub-indicator has the highest percentage compared to sub-indicators 2, 3, and 4. Sub-indicators 2 and 3 have the same percentage of 83% Whereas the lowest sub-indicator is sub-indicator number 4.

Table 7.
Tabulation of Supporting Facilities Indicator

No	Items	Y	N	(%)
1	There is a well-maintained changing area, wash basin, and sanitation facilities in the woodworking workshop	30	5	86%
2	There is a theory room that is used for theoretical learning before carrying out practice	29	6	83%
3	There are pictures or writings on dangerous places	29	6	83%
4	There are pictures or writings on places that require Personal Protective Equipment (PPE)	28	7	80%
Total Average				**83%**

6. Workshop Layout Variable Recapitulation

The recapitulation of the workshop layout variables is the average percentage of each workshop layout indicator. From the average of each indicator, the average for the workshop layout variable can be derived. The results of the workshop layout variable recapitulation can be seen in Table 8.

Table 8.
Workshop Layout Variable Recapitulation Result

No	Indicator	Percentage (%)	Assessment
1	Workplace design	66%	Good
2	Storage and handling of materials	79%	Good
3	Equipment layout	86%	Good
4	Lighting	77%	Good
5	Supporting facilities	83%	Good
Total Average		**78%**	**Good**

Based on the recapitulation results in Table 8 above, the workshop layout variable graph is presented in Figure 1.

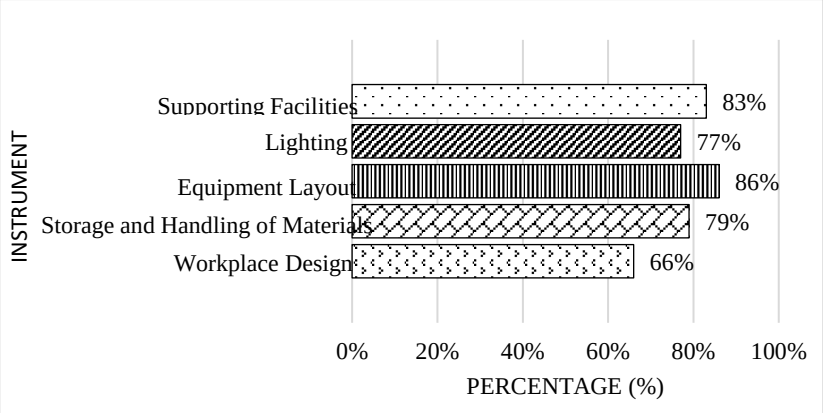

Figure 1. Workshop Layout Variable Graph

B. Health and Safety Work Variable

1. Health and Safety Policy (K3) Indicator

The implementation of health and safety (K3) in the woodworking workshop can be observed through the K3 policy indicator. This indicator consists of 3 sub-indicators: K3

guidelines, K3 procedures, and hazard prevention. The tabulation results of the K3 policy indicator can be seen in Table 9.

Table 9.
Tabulation of Health and Safety Policy Indicator

No	Items	Y	N	(%)
1	The woodworking workshop has specific and written Health and Safety (K3) guidelines	30	5	86%
2	Practical activities in the woodworking workshop adhere to the Health and Safety (K3) guidelines	33	2	94%
3	Users of the workshop understand and apply the Health and Safety (K3) policies of the woodworking workshop	32	3	91%
4	Health and Safety (K3) procedures in the woodworking workshop are sufficiently good	32	3	91%
5	There is socialization about K3 policies and procedures, both orally and in writing (Posters)	31	4	89%
6	There is information about steps to identify hazards in the woodworking workshop	31	4	89%
	Total Average			**90%**

2. Leadership and Commitment Indicator

The implementation of Health and Safety (K3) in the woodworking workshop can be seen through the leadership and commitment indicator. This indicator consists of 2 sub-indicators: technician involvement and K3 guidelines. The tabulation results of the leadership and commitment indicator can be seen in Table 10.

Table 10.
Tabulation of Leadership and Commitment Indicator

No	Items	Y	N	(%)
1	Technicians in the woodworking workshop have an understanding and awareness of K3	35	0	100%
2	Technicians can identify and resolve issues that occur in the woodworking workshop	35	0	100%
3	There are guidelines regarding Health and Safety (K3) along with K3 regulations	35	0	100%
4	Health and Safety (K3) guidelines in the woodworking workshop are clear and easy to understand	35	0	100%
5	Health and Safety (K3) guidelines help minimize work accidents	35	0	100%
	Total Average			**100%**

3. Management of Health and Safety (K3) Indicator

The implementation of K3 in the woodworking workshop can be seen through the K3 management indicator. This indicator consists of 2 sub-indicators: Standard Operating Procedures (SOP), maintenance and preservation, and incident reporting. The tabulation results of this indicator can be seen in Table 11.

Table 11.
Tabulation of Health and Safety Management (K3) Indicator

No	Items	Y	N	(%)
1	The woodworking workshop has established and disseminated written Standard Operating Procedures (SOPs)	33	2	94%
2	The Standard Operating Procedures (SOPs) in the woodworking workshop are clear and easily understood	32	3	91%
3	The implemented Standard Operating Procedures (SOPs) effectively enhance the quality of work in the woodworking workshop	34	1	97%
4	Machine maintenance in the woodworking workshop is scheduled	27	8	77%
5	Machines experiencing damage will be promptly repaired	31	4	89%
6	There is a specialized Health and Safety (K3) officer handling first aid in case of accidents in the woodworking workshop	18	17	51%
	Total Average			**83%**

4. Hazard Identification Indicator

The implementation of occupational health and safety (OHS) in the woodworking workshop can be observed through the hazard identification indicator. This indicator consists of 1 sub-indicator, namely the source of hazards and compliance with Standard Operating Procedures (SOP). The tabulation results of the hazard identification indicator can be seen in the following Table 12.

Table 12.
Tabulation of Occupational Health and Safety (OHS) Management Indicator

No	Items	Y	N	(%)
1	Users of the workshop can identify hazards in each of their equipment	31	4	89%
2	Users of the woodworking workshop can operate hazardous equipment correctly and safely following the Standard Operating Procedures (SOP)	35	20	100%
	Total Average			**94%**

5. Safety Control Indicator

The implementation of Occupational Health and Safety (OHS) in the woodworking workshop can be observed through the safety control indicator. This indicator consists of 4 sub-indicators, namely compliance with SOP, personal protective equipment, equipment usage tutorials, and equipment maintenance. The tabulation results of the safety control indicator can be seen in Table 13.

Table13.
Tabulation of Occupational Health and Safety (OHS) Management Indicator

No	Items	Y	N	(%)
1	Standard Operating Procedures (SOP) consistently applied by all workshop users	33	2	94%
2	Personal Protective Equipment (PPE) appropriate for each equipment	30	5	86%
3	Training or tutorials on equipment usage conducted before practice sessions	33	2	94%
4	Regular maintenance performed on woodworking workshop equipment	30	5	86%
5	Established procedures for equipment maintenance	33	2	94%
	Total Average			**91%**

6. Indicator of Awareness of Health and Safety at Work

The implementation of OHS in the woodworking workshop can be observed through the indicator of awareness of Health and Safety at Work. This indicator consists of 3 sub-indicators: the 5R culture (Resik, Rawat, Rapi, Ringkas, Rajin), Standard Operating Procedures (SOP), and Personal Protective Equipment (PPE). The tabulation results for this indicator can be seen in Table 14.

Table 14.

Tabulation of the Awareness Indicator of Health and Safety at Work

No	Items	Y	N	(%)
1	The 5R (Resik, Rawat, Rapi, Ringkas, Rajin) is always implemented in the woodworking workshop	33	2	94%
2	The implementation of 5R (Resik, Rawat, Rapi, Ringkas, Rajin) increases efficiency and productivity during practice in the woodworking workshop	34	1	97%
3	The implementation of Standard Operating Procedures (SOP) helps reduce the number of work accidents in the woodworking workshop	34	1	97%
4	Personal Protective Equipment (PPE) is always used by workshop users practicing in the woodworking workshop	26	9	74%
	Total Average			**91%**

7. Occupational Health and Safety (OHS) Monitoring & Evaluation Indicator

The implementation of Occupational Health and Safety (OHS) in woodworking workshops can be seen through the Occupational Health and Safety monitoring & evaluation indicator. This indicator consists of 4 sub-indicators, namely the application of OHS, compliance with Standard Operating Procedures (SOPs), Personal Protective Equipment (PPE), and the level of work accidents. The tabulation results on this indicator can be seen in Table 15.

Table15.

Tabulation of the Monitoring & Evaluation Indicator of Health and Safety at Work

No	Items	Y	N	(%)
1	Woodworking workshop users always follow the established Health and Safety (HSE) procedures	31	4	89%
2	Workshop users are aware of the importance of implementing Health and Safety (HSE) measures	34	1	97%
3	Workshop users practice according to the Standard Operating Procedures (SOP) for each tool	32	3	91%
4	Personal Protective Equipment (PPE) is adequately available in the woodworking workshop	26	9	74%
5	Personal Protective Equipment (PPE) available in the workshop is in good, clean, and well-maintained condition	28	7	80%
6	There are work accidents that occur in the woodworking workshop during practical learning hours	20	15	57%
7	There are work accidents that occur outside the supervision of workshop technicians	21	14	60%
	Total Average			**78%**

8. Recapitulation of Health and Safety Variables

The recapitulation of Health and Safety variables is the average percentage of each Health and Safety indicator. From the average of each of these indicators, the overall average

for the Health and Safety variable can be determined. The results of the recapitulation of Health and Safety variables in the workshop can be seen in the following Table 16.

Table 16.
Recapitulation of Workshop Layout Variables Result

No	Indicator	Percentage (%)	Assessment
1	Health and Safety Policy	90%	Good
2	Leadership and Commitment	100%	Good
3	Health and Safety Management	83%	Good
4	Hazard Identification	94%	Good
5	Safety Control	91%	Good
6	Awareness of Health and Safety	91%	Good
7	Health and Safety Monitoring & Evaluation	78%	Good
	Total Average	**90%**	**Good**

Based on the recapitulation results in Table 8 above, the graph of health and safety variables is as follows.

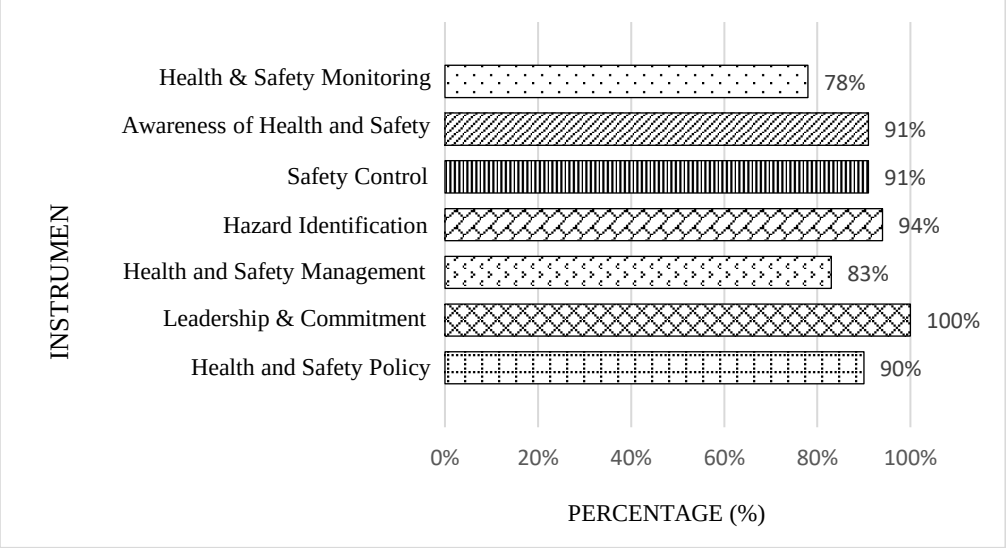

Figure 2. Graph of health and safety variables

CONCLUSION

There is conformity between the layout of the UNY DPTSP woodworking workshop and the 2010 ILO & IEA regulations with an average percentage of 78%. The percentage shows that the suitability of the layout of the Woodworking Workshop of DPTSP UNY with the 2010 ILO & IEA regulations is included in the good assessment category. This is supported by the highest percentage found in the equipment layout indicator with a percentage of 86%. In the equipment layout indicator, there are 3 sub-indicators, namely, the availability of tools, the layout of tools, and the storage and maintenance of tools. Meanwhile, the indicator with the lowest percentage is the lighting indicator with a percentage of 77%. In the lighting indicator, there are 5 sub-indicators, namely, optimization of light, use of color, lighting, prevention of glare, and maintenance of workshop lighting.

There is conformity of Occupational Health and Safety (OHS) in the woodworking workshop of DPTSP UNY with SNI 45001 2018 with an average percentage of 90%. This percentage shows that the suitability of K3 in woodworking workshops with SNI 45001 2018 is included in the good assessment category. This is supported by the existence of indicators that have the highest percentage, namely leadership and commitment indicators with a percentage of 100%. In the leadership and commitment indicators, there are 2 sub-indicators, namely technician involvement and K3 instructions. Meanwhile, the indicator with the lowest percentage is the OHS monitoring & evaluation indicator with a percentage of 78%. In this indicator, there are 4 sub-indicators, namely, the application of OHS, compliance with Standard Operating Procedures (SOPs), Personal Protective Equipment (PPE), and the level of work accidents.

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