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COMPARATIVE STUDY ON HAZARD IDENTIFICATION AND RISK ASSESSMENT IN ACADEMIC LABORATORY

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Abstract:
Laboratory work, practical work as well as practical work-related experiment usually are carried out in a student-oriented laboratories. However, there are a broad wide of hazardous substance & equipment and no comprehensive review on hazard identification and risk assessment in academic laboratory. In this paper, a comparative study on hazard and risk assessment in academic laboratory was conducted to discuss on hazard and to address the various control measure to overcome or eliminate the hazard. A total of 64 publications on the hazard and risk assessment in academic laboratory were identified from Scopus, IEEE, Google Scholar, and manual searching. The study was guided by PRISMA and 9 selected journals were reviewed and integrated. From the comparison studies there are various types of hazard that can be found in academic laboratory such as chemical, physical, biological, electrical, and psychosocial. 44% discussed on specified hazard which is chemical and electrical and 56% discussed on non-specified hazard. 43% used qualitative, 36% semi- qualitative and 21% quantitative method. Several recommendation such as provides a fixed standard system for hazard identification in academic laboratory and produce more experts in research paper is urged in order to improve and make progress for the future.
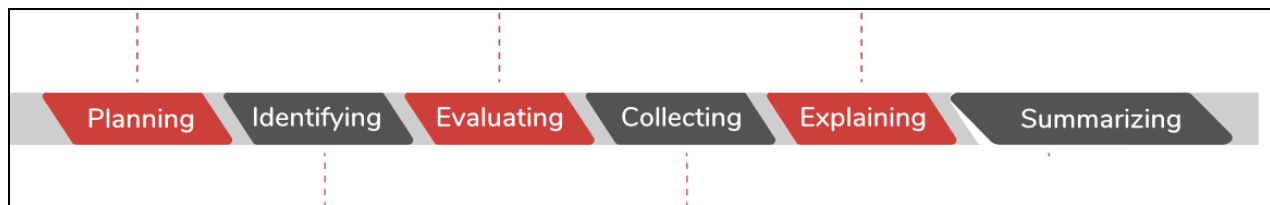
*Keywords***:**
hazard identification, risk assessment, academic laboratory

Objectives:
- To discuss on hazard identification and risk assessment in academic laboratory by comparative study.
- To address the various control measure to overcome or eliminate the hazard.

Methodology:

Planning — Identifying — Evaluating — Collecting — Explaining — Summarizing

Results:

Method	Type of research	Hazard identification Method	Result
ACHiL	Semi-quantitative, Qualitative	The approach is to define the threat, and to continue with the risk analysis assessment in scale.	28 specific hazard identified
Observational, cross-sectional study	Semi-quantitative	Primary data obtained through laboratory interviews and observations as well as reports which is presented in tables and analyzed descriptively.	10 potential hazard. (12 risks from 4 activities)
Chem-SAM, UOW,SQRA	Semi-quantitative	Consist of five stage; Prepare list of chemicals, chemical risk assessment with Chem-SAM model, chemical risk assessment, UOW method, chemical risk assessment with SQRA method, and lastly compare in statistical analysis. (Analytical-descriptive)	Three method have almost same results. It is simple with no cost but lack in research in other workplace and environments. The high-risk rating is from the use of formaldehyde, benzene, sulphuric acid. The risk of the hazardous chemical at the laboratories was significant and control measure should be applied.
5S practice, FMEA, AHP, VIKOR technique	Semi-quantitative	By checklist and in-site inspections. Three steps; based on 5s result practices and literature laboratory searched, risk score calculation, risk priority and control measure potential	Application of new OHS risk assessment approach which managed to identify occupational hazards including chemical, biological, physical mechanical, electrical, ergonomic, and psychosocial and proposed recommended control measure.
Bayesian network, bow-tie method	Semi-quantitative	Bayesian network analyze probability with insufficient data by obtaining predictive analysis of the state of certain roots for given accident scenario.	The findings indicate that hazardous worker actions and the concentration of poisonous and dangerous gases have the greatest effect on the risk of gas leakage. The outcome of this study helps to increase the standard of gas protection management in school laboratory and to minimize the incidence of gas leakage.
Observational	Semi-	Stages; hazard identification,	16 hazard from five activities.

research ; HIRADC	quantitative	risk analysis, risk analysis, determining control. Data are analyzed descriptively.	
Lab-HIRA, Checklist, What-If, Hazop	Qualitative	Three parts: Chemical Hazard Review (CHR) which first analysis risk, assemble documentation, conduct risk analysis, and estimate deviation risk.	HAZOP shows a similar analysis result to SWIF analysis. A formal risk assessment is equally applicable to the chemical synthesis analysis in research lab.
Bowtie diagram	Qualitative	Bowtie diagrams is structured approach in identifying safety key barriers and control. It can be monitored to prevent barrier degradation.	Improve laboratory risk managements. Inadequate, bypassed or barriers had failed can be investigated. Inadequate, bypassed or barriers had failed was investigated and found. There were no written formal procedures, no rules/policy on personal protection equipment (PPE), Insufficient supervision, Lack of communication. Improve laboratory risk managements
CHRA, RSLs	Semi-quantitative	Cross-sectional analytical study. The analysis used descriptive statistics and Excel software for comparison of the two.	Comparisons have shown that RSLs is an objective tool with no personal opinion. CHRA is a clear method for larger, risk-categorizing chemicals. But CHRA includes fewer parameters than RSLs, as well as personal opinion. The two method complement each other.

Conclusion:

In conclusion, the study managed to discuss on hazard identification and risk assessment in academic laboratory where 43% used qualitative method, 36% semi- qualitative and 21% quantitative method. Moreover, various control measure managed to be identified to overcome or eliminate the hazard. The types of hazards found in academic laboratories, such as chemical , physical, biological, electrical, psychosocial hazards on the reviewed articles.