

CHEMISTRY LABORATORY SAFETY BEHAVIOR OF STUDENT IN FACULTY OF SCIENCE AND TECHNOLOGY AT SUAN SUNANDHA RAJABHAT UNIVERSITY.

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ABSTRACT

This research aims to study the safety behavior of students in the chemistry laboratory of Faculty of Science and Technology, Suan Sunandha Rajabhat University. The two hundred and fifty students were selected by random sampling and the data were collected with safety behavior questionnaires. After that, the data was analyzed by percentage mean and standard deviation. The result indicated that the data sample consisted of female and male students of 66 percent and 34 percent, respectively. The students never had laboratory hazards 63.2 percent while 36.8 percent of students had some laboratory hazards. The hazard from unsafe laboratory behavior of students were dizziness from chemicals, irritated nose, chemical spill and slip or fall 37 percent, 27.4 percent, 25.3 percent and 3.9 percent, respectively. The causes of hazard in chemistry laboratory were arisen from not wearing personal protective equipment 21.9 percent, uncomfortable and inappropriate dress 17.4 percent, improper working procedure 15.4 percent, unsafe or defective equipment 13.8 percent. The top three positive safety behaviors of students that reduced the risk of chemical hazardous were reporting the problem immediately to the laboratory advisor followed by wearing a personal protective equipment all the times and following the good laboratory practices. On the other hand, the top three negative behaviors that increased the risk of chemical hazards were using mobile phone followed by playing and eating or drinking while doing the experiments.

Keywords: behavior, safety, chemistry laboratory

INTRODUCTION

Chemical laboratory contains significant risks. The hazards and potential risks associated with the chemicals and laboratory operations, such as the chemical explosion, a fire, chemical spill, chemical hazards caused by lack of safety knowledge and security awareness, affect the health of workers. Accidents in chemical laboratories, such as limited experience, mishandling of chemicals and lack of knowledge about the proper actions to be taken in emergency cases have been reported worldwide for several reasons [1]. Laboratory safety consists of personal factors, attitude, beliefs, personality, knowledge, skills, and abilities, environmental factors, facilities, location, equipment, procedures, and standards and behavioral factors, safe and risky practices [2], [3]. 80-90 percent of accidents in the laboratory are caused by the behavior [4]. Therefore, academic laboratory safety can be considered the minimum requirements for working in laboratory. The science laboratory help the students develop abilities necessary to do scientific inquiry and gain understanding about scientific inquiry and it is a process that students learn parallel to science content [5]. Teachers play an important role to contribute students to regard hazardous chemicals and to

raise safe habits in the laboratory session continually. Moreover, teachers and students should be aware of safety in science laboratories.

Department of Chemistry, Faculty of Science and Technology Suan Sunandha Rajabhat University arrangements more than 20 groups to chemical operations practice in each semester that results in the chemical laboratories being used all the time. It increases the chances of risk in the laboratory but students have high level of satisfaction emphasized the need for laboratory staff to be responsive to students' needs, the chemistry library having basic safety and comfort for study and having adequate scientific instruments, equipment and material [6]. This research was conducted to study the safety behavior in chemical laboratory of students in order to determine level of safety knowledge and awareness of the rules and safety for using chemical laboratory. The information obtained from this study will be used as a guideline to find ways to prevent danger and reduce potential loss for the practitioner in the laboratory and the property of the university.

METHODOLOGY

The study was conducted at the faculty of science and technology, Suan Sunandha Rajabhat University, in Bangkok, Thailand in 2018-2019. The two hundred and fifty students were selected by random sampling from the students who used chemistry laboratories from October 2018 to July 2019. Data was collected by using structured questionnaires which divided into 3 parts to assess the behavior of chemical laboratory safety among the undergraduate university students. The first section consisted of 7 demographic questions including different variables: gender, age, major, academic year, previous experience of laboratory hazards, the causes of hazard in chemistry laboratory, laboratory hazards frequency and the feature of injuries caused by the use of chemical laboratories. The second section consisted of five Likert scale questions to assess the behavior of students towards safety in chemical laboratories. The last section was additional problems and suggestions. Data were analyzed using descriptive statistics, which included the means standard deviations and percentage. To analyze the responses in section 2 of the questionnaire, the data was transformed to a score that was calculated for each of the responses to statements used a five-point Likert scale by assigning a score of '5' for doing every time, '4' for doing almost every time (70-90%), '3' for doing sometimes (40-60%), '2' for doing rarely (10-30%) and '1' for never for positive questions (1-5) and converted score for negative questions (6-10). After calculating the mean scores, they were each categorized into every time, almost always, sometimes, rarely, never practice. Categories were as follows: 4.50 to 5.00 = every time, 3.50 to 4.49 = almost always, 2.50 to 3.49 = sometimes, 1.50 to 2.49 = rarely and 1.00 to 1.49 = never.

RESULT AND DISCUSSION

The demographic data showed that 66 % of the 230 student respondents were female. Most students never had laboratory hazards (63.2 %) while 36.8 percent of students had some laboratory hazards. The hazard from unsafe laboratory behavior of students were dizziness from chemicals, irritated nose, chemical spill and slip or fall 37 percent, 27.4 percent, 25.3 percent and 3.9 percent, respectively (Table I). The causes of hazard in chemistry laboratory were arisen from not wearing personal protective equipment 21.9 percent, uncomfortable and inappropriate dress 17.4 percent, improper working procedure 15.4 percent, unsafe or defective equipment 13.8 percent (Table II). The top three positive safety behaviors of students that reduced the risk of chemical hazardous were reporting the problem immediately to the laboratory advisor followed by wearing a personal protective equipment all the times and following the good laboratory practices. On the other hand, the top three negative

behaviors that increased the risk of chemical hazards were using mobile phone followed by playing and eating or drinking while doing the experiments. The Table I also shows the detailed frequencies and percentages for each category within the nature of injuries caused by the use of chemical laboratory and The Table II shows the detailed frequencies and percentages for each category within the causes of hazard in chemistry laboratory.

Table I. Frequency distribution of the nature of injuries caused by the use of chemical laboratory.

The nature of injuries	Frequency	Percent
Dizziness from Chemicals	104	37.0
Nasal Irritation	77	27.4
Chemical Spill	71	25.3
Slip Down or Fall	11	3.9
Wounds from Sharp Objects	8	2.8
Fire Wounds	6	2.1
Electric Injury / Electric Shock	4	1.4

Table II. Frequency distribution of the causes of hazard in chemical laboratory.

The causes of hazard in chemical laboratory.	Frequency	Percent
Not wearing personal protective equipment.	68	21.9
Uncomfortable and inappropriate dress.	54	17.4
Improper working procedure.	48	15.4
Unsafe or defective equipment.	43	13.8
Tease each other while working.	38	12.2
Crowded working area	18	5.8
Bad ventilation.	18	5.8
Dirty working area and inappropriate equipment placement.	18	5.8
Insufficient lighting.	6	1.9

Table III. The percentage of safety behavior in chemical laboratory.

Safety behavior in chemical laboratory	Level in practice (%)				
	Every time	Almost always	Some times	rarely	Never
Follow prohibitions, warning signs in the chemical laboratory	141 (56.4)	72 (28.8)	33 (13.2)	3 (1.2)	1 (0.4)
Wear protective clothing or personal protective equipment while working of all time	143 (57.2)	85 (34)	18 (7.2)	1 (0.4)	3 (1.2)
Always read the label beside the chemical container before use	143 (57.2)	57 (22.8)	43 (17.2)	3 (1.2)	4 (1.6)
Use equipment in the laboratory correctly according to the instruction manual	123 (49.2)	85 (34)	40 (16)	1 (0.4)	1 (0.4)
Report to the laboratory administrator when abnormalities are found	173 (69.2)	48 (19.2)	19 (7.6)	3 (1.2)	7 (2.8)

Bring food, beverage into the laboratory	2 (0.8)	7 (2.8)	72 (28.8)	69 (27.6)	100 (40.0)
Eat, drink in the laboratory	2 (0.8)	5 (2.0)	25 (10.0)	99 (39.6)	119 (47.6)
Use telephone, communication equipment while working in the laboratory	21 (8.4)	49 (19.6)	74 (29.6)	62 (24.8)	44 (17.6)
Tease each other while working	3 (1.2)	16 (6.4)	61 (24.4)	69 (27.6)	101 (40.4)
Drink alcohol or alcoholic beverages before or while working in the laboratory	2 (0.8)	4 (1.6)	1 (0.4)	6 (2.4)	237 (94.8)

The safety behavior in chemical laboratory of students show in Table III and Table IV. The survey results show that 50 percent of students have safety behaviors in the chemical laboratory every time. When abnormality are found, students will report to the laboratory administrator and they don't drink alcoholic beverage before or while working in the laboratory every time. Students almost always have behavior that causes safety in the laboratory. The top three positive safety behaviors of students that reduced the risk of chemical hazardous were reporting the problem immediately to the laboratory advisor followed by wearing a personal protective equipment all the times and following the good laboratory practices. On the other hand, the top three negative behaviors that increased the risk of chemical hazards were using mobile phone followed by playing and eating or drinking while doing the experiments.

Table IV. The mean and standard deviation of safety behavior in chemistry laboratory

Safety behavior in chemical laboratory	\bar{x}	SD
Follow prohibitions, warning signs in the chemical laboratory	4.40	0.79
Wear protective clothing or personal protective equipment while working of all time	4.46	0.75
Always read the label beside the chemical container before use	4.33	0.91
Use equipment in the laboratory correctly according to the instruction	4.31	0.78
Report to the laboratory administrator when abnormalities are found	4.51	0.90
Bring food, beverage into the laboratory	1.97	0.94
Eat, drink in the laboratory	1.69	0.80
Use telephone, communication equipment while working in the laboratory	2.76	1.20
Tease each other while working	2.00	1.01
Drink alcohol or alcoholic beverages before or while working in the laboratory.	1.11	0.55

CONCLUSION

Students of the Faculty of Science and Technology, Suan Sunandha Rajabhat University are not aware enough about laboratory safety. They do not follow the rules and regulations every time that it can contribute to accident happen in laboratory and affect to collaborators [7]. Therefore, Chemistry Laboratory teachers and laboratory administrators should find ways to give students a positive attitude towards following the safety rules that is the key to create a culture of safety [8], [9] and to prepare safety measures. Moreover, Chemistry Laboratory Teachers should be sufficient safety training in the laboratory for students.

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