



Chemical Safety: Knowledge, Attitude and Practices of Science Teachers

Nadia Ijaz, Dr. Samina Malik

International Islamic University Islamabad (Pakistan)

ibmughal1983@gmail.com, Samina.malik@iiu.edu.pk

Abstract

Practical work has a priority role for the teaching-learning process of sciences. There are many potential hazards when working with chemicals, but all of them can be avoided with the appropriate knowledge, attitude and practices while working in the labs. The main purpose of this study was to assess the knowledge, attitude and practices of science teachers regarding chemical safety at secondary level. Teachers having sound knowledge about the chemicals, positive attitude and good practices in chemical handling can minimize the risk of chemicals hazardous, protect them from chemical calamities and control chemical hazards to protect human health and school environment. The target population of the study was all science teachers of Public Sector Schools of Islamabad city. Through purposive random sampling, 137 science teachers (male and female) were selected. Data were collected through semi-structured questionnaire. The descriptive statistics using frequency, percentage distribution of responses were calculated. The study concluded that amongst the three levels knowledge, attitude and practice the respondents were better in knowledge but the attitude and practice did not show remarkable scores, which means that more efforts are required to improve the attitude and practices regarding chemical safety.

Introduction

In teaching of Science the practical work is of great importance as it develops the confidence of doing something by one's own self. Practical work not only enhances the knowledge about a particular phenomenon but also explains the underlying ideas about it (Cooper stock, 2009). Chemistry and chemicals have an essential place in science, and safe chemical practices are the most basic and fundamental parts of laboratory experiments. Chemical safety is the prevention of the adverse effects, both short- and long-term, to humans and the environment from the production, storage, transportation, use and disposal of chemicals. (WHO 2009). There are four main ways that is routes of exposure, for chemical substances to enter the human body: Inhalation, Absorption, Ingestion (eating, swallowing), Transfer across the placenta of a pregnant woman to unborn baby

Handling chemical substances without proper precautions exposes the students, teachers and other allied staff to the risk of absorbing harmful amounts of chemicals. It is obligatory for the school administration to provide the guidelines to the respective teachers and lab attendants about the nature, properties, classification labeling, transport and storage of chemicals so that they could disseminate the information to the students before the performance of practical task for the safe use of chemicals and to minimize the risk of chemical injuries. Governments from around the world have agreed that addressing chemical threats to children's health should be an integral component of every country's public health and environmental agenda.



The present study has not only figured out the contemporary knowledge of science teachers about chemical safety in Public schools but also helped to know the level of practical implications of this knowledge at real laboratory environment. This study would also help researchers to develop future chemical safety programs at school levels and to analyze and explore all those ways preventing accidents with knowledge and habit of safety.

Several studies are evident about the importance of safety measures in labs. According to the survey of Gerlovich, Whitesett, Lee & Parsa, (2001) mostly the accidents and injuries in the laboratory are caused by the broken glassware and chemical exposure. The teachers who have class sizes greater than 24 students are at greater risk of being injured (Fuller, Picucci & Collins, 2001). Overcrowding in Science Classrooms and laboratories, where equipment and chemicals are used, should be a safety concern for every teacher and student (TEA & DANA Center, 2000). In Pakistan the situation is worse because of the lack of facilities, resources and proper management so this present study was conducted not only to analyze the knowledge, attitude and practices of Science teachers regarding chemical safety in laboratory, but also to point out the deficiencies present in the system, and to remove those deficiencies proper suggestions are given so that the government, school administration and other stake holders could take steps to fulfill the gap.

Chemical Safety other than environmental health issues has been given less attention especially in academic institutions as well as agriculture sector in Pakistan. There has been an effort to manage these chemicals in industrial sectors. In academic institutions there is no inventory of hazardous chemicals and no appropriate disposal of these so-called chemicals. There is no protocols or SOPs for the safe disposal of chemicals which are being used by the students during their practical work at the work place. Moreover there is no training programs and no curriculum development regarding these chemicals which impart health impacts if they are not used properly in the laboratory.

Methodology

The major objectives of this study were 1. To assess the knowledge level of Science teachers about chemicals and their hazardous effects on human health; 2. To find out the attitude of science teachers towards safe use of chemicals in laboratory; 3. To investigate the practices being used in laboratory that prevents chemical hazards to ensure the health safety.

Population and sample

This survey was conducted in the capital city (Islamabad) of Pakistan. The population of the study was Secondary school Science teachers currently working in the Public schools of Islamabad. From the list provided by ministry of education it was found that there are about 108 schools situated in different sectors of Islamabad then 30% of the total number of Public schools was taken as sample (34 schools), out of which 50% were boys and 50% were girls schools. Then those 30% schools were selected by purposive random sampling depending upon the availability of science laboratory in schools. At least three science teachers were asked to fill the questionnaire from each school to assess about knowledge, attitude and practices.

Research instrument & data collection and analysis

A semi-structured questionnaire was developed for the collection of data. Data were collected through questionnaire in personal. . . Questions in the knowledge, attitude and practice section were analyzed separately, numerical values or score were assigned to each choice in the range of responses and in this way the score was calculated.



Results

Table 1. Knowledge * Attitude

Knowledge * Attitude								
		Knowledge					Total	
		VP	P	S	G	VG		
Attitude	0	Count	2	7	6	5	0	20
		% within CR	28.6%	30.4%	15.8%	16.1%	.0%	19.6%
	1	Count	4	12	12	11	0	39
		% within CR	57.1%	52.2%	31.6%	35.5%	.0%	38.2%
	2	Count	0	2	5	7	2	16
		% within CR	.0%	8.7%	13.2%	22.6%	66.7%	15.7%
	3	Count	1	2	13	5	1	22
		% within CR	14.3%	8.7%	34.2%	16.1%	33.3%	21.6%
	4	Count	0	0	2	3	0	5
		% within CR	.0%	.0%	5.3%	9.7%	.0%	4.9%
	Total	Count	7	23	38	31	3	102
		% within CR	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

The results show the poor knowledge (30.45) of the respondents for disagreeing about the safe use of the chemicals and the practices for the safe disposal of the chemicals.

Table 2. Knowledge * Practice

Practice * Combined Cross tabulation								
		Combined					Total	
		VP	P	S	G	VG		
Practice	Rarely	Count	3	5	6	3	0	17
		% within CR	42.9%	21.7%	15.8%	9.7%	.0%	16.7%
	Sometime	Count	4	12	18	14	0	48
		% within CR	57.1%	52.2%	47.4%	45.2%	.0%	47.1%
	Regularly	Count	0	6	14	14	3	37
		% within CR	.0%	26.1%	36.8%	45.2%	100.0%	36.3%
Total	Count	7	23	38	31	3	102	
	% within CR	100.0	100.	100.0	100.0	100.0	100.0%	

The results show that highest percentage (45.2%) of the individuals was observed who with good knowledge to exercise their practices regularly. While as 42.9% were observed who had very poor knowledge and poor practices to do. Similarly high percentage (36.3%) of individuals was observed to practice their knowledge and work. The individuals, who had not good knowledge, were working rarely to ensure the practices for the safe disposal of chemicals. The individuals having satisfactory knowledge were found 47.4% and they practice sometime for the safe management of the chemicals in their schools.



Table 3. Attitude * Practice

Practice * Combined results Cross tabulation								
			Combined results					Total
			DA	SDA	UD	A	SA	
Practice	Rarely	Count	2	10	1	2	2	17
		% within CR	10.0%	25.6%	6.2%	9.1%	40.0%	16.7%
	Sometime	Count	10	17	7	12	2	48
		% within CR	50.0%	43.6%	43.8%	54.5%	40.0%	47.1%
	Regularly	Count	8	12	8	8	1	37
		% within CR	40.0%	30.8%	50.0%	36.4%	20.0%	36.3%
Total		Count	20	39	16	22	5	102
		% within CR	100.0	100.0%	100.	100.0%	100.0%	100.0%

16.7% respondents had attitude from disagree to agree. A high percentage (40.0%) of individuals were strongly agree to manage the chemicals in the best possible way but they practice rarely to work out regarding the safe use of chemicals. 20.0% strongly agree and 36.4% individuals were agreeing to ensure the safe use and disposal of chemicals regularly in the laboratories. Only 25.6% respondents were disagreeing regarding the safe management of chemicals and rarely practice to ensure occupational safety while using chemicals at schools.

Discussion

It was observed in this study that there was no safety inspection by the schools administration or district authority regarding the safe use of chemicals. In other study of Nebraska teachers surveyed 48% indicated that safety inspections were not conducted (Gerlovich & Woodlawn, 2001). Most of the teachers in the schools were not given safety training and poor practices were observed in the workplaces. (Lee & Parsa, 2001) observed that injury related accidents in the science class room are caused by burns when students pick up hot objects and when students cut themselves on broken glasses.

Conclusion & recommendations

School administrators and teachers have an important role to play in reducing the hazards of the chemicals used in the laboratory by taking specific actions and adopting policies that promote chemical safety in the schools. Unfortunately weak practices were observed in almost all schools because of lack of awareness and proper education for the safe use of the chemicals and their proper disposal. Teachers were not fully aware about the hazards of the chemicals and no protective clothing or MSDS were present at workplace to guide the students. Poor practices about the segregation of the chemicals were observed and all chemicals were poured in the drainage to contaminate the water quality. But unfortunately our school system lacks concerned staff, solid policies, health & safety standards to protect environment and future generation. The best method for handling chemicals is documented management plan which includes written procedures and school information. The chemical management plan should be reviewed annually and updated to reflect the current practices, allow administration and teachers to track incoming chemicals. The science teacher need to determine what chemicals are needed and will be used, and what are not needed and can be properly disposed and ensure that a copy of the Material Safety Data Sheet (MSDS) for each remaining chemical is present at the site and available for review. This will protect



3rd Edition

students against any burn and chemical spillage in the laboratory. The school administration/science teachers may evaluate the storage, locations and storage systems to ensure that chemicals are stored properly and handled safely. Teacher and student must be trained regarding the safe use and disposal of chemicals. There is need to maintain the sense of trust between the district and surrounding community. There should be sensitization programs at district level for the capacity building of the teachers to manage and reduce the health hazards associated with the use and disposal of the chemicals.

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